Global Information Assurance Certification Paper

GIAC Certified Intrusion Analyst (GCIA) Practical Assignment Version 3.3

Mohammed Haron
Submitted April 24th, 2003

Table of Content:

Assignment 1: Describe the State of Intrusion Detection

With Intrusion Prevention, Is There Still A Need For Intrusion Detection?

Summary

In this assignment, I will discuss why there is still a need for Intrusion Detection technology to exist and complement the latest Intrusion Prevention technology, which evolved from Intrusion Detection technology and firewall technology. First, I will briefly explain what is Intrusion Detection technology and functions of Intrusion Analysts in IDS world. Then, I will discuss briefly about Intrusion Prevention technology and best practices in "perfect world" for IPS to function. Finally, I will discuss main differences between Intrusion Prevention and Intrusion Detection technologies, and the future of IDS.

Introduction

Intrusion Prevention is the new buzzword in the Information Security field. It is a new technology that combined the best features of both intrusion-detection and firewall. Intrusion detection is capable of detecting attack in progress and alerting analyst to take action while firewall block attacks from passing through according to access control policies enforced. Static policies enforced on firewalls and alerting analyst on attack detected by intrusion detection system, are no longer ample in handling the magnitude of new automated attacks generated by worms, virus and other malicious tools. Experiences with Code Red worm, Nimda worm and Slammer worm really showed the how fast these attacks were spreading and damages were done in a very short period of time. Slammer worm for example, only requires two infected hosts to bring down a whole subnet in Local Area Network.

In intrusion prevention system, the emphasis is automation in blocking attack detected by the intrusion detection component. John Pescatore, a research director for Internet security at Gartner stated, "If the intrusion-detection function or the antiviral-detection function says this is an attack, and the network is vulnerable to that attack, the firewall blocks it or shunts the packet off to some sage destination, thwarting the attack". [23]

Intrusion Detection System

Intrusion Detection Systems (IDS) is decision support system for security analysts. It is not about preventing or blocking incoming attacks, but it is about identifying source of the attack, assess the damage caused by the attack, prevent future break-ins and to prevent attack from spreading. IDS looks at the patterns of the traffic going through your networks, examine each packet and try to make intelligent decisions regarding their findings and then alert security analyst for action to be taken. [34]

Basically, IDS can be categorized to three different type; Network Intrusion Detection System (NIDS), Host Intrusion Detection System (HIDS) and Hybrid.

1. Network Intrusion Detection System (NIDS)
   NIDS is basically deals with information passing on the wire in a network. It intercepts packets traveling along various communication mediums and protocols, such as TCP/IP, and analyzed in a number of ways depending on the capabilities of the IDS. Signature based NID will simply compare the packet to a signature database of known attack and vulnerabilities, while protocol anomaly look for anomalous behavior deviating from the RFCs and normal known traffics.

   Even though NIDS were initially incapable to operate in switched networks, encrypted networks and a very high speed network (Gbits), new NIDS products and solutions have resolved these limitations. NIDS can be deployed in switched environment by using TAPS, hubs or spanning port, while encrypted network can still be monitored by NIDS at packet header level which is not encrypted in SSL or VPN connection. However, a product called BIGIP provides integrated SSL encryption and decryption on real-time that decrypted traffics can then be monitored by NIDS.[55] Many new NIDS are also capable of handling Gbits network such as Network Sensor NS3000, a product from Sourcefire. [56]

2. Host Intrusion Detection System (HIDS)
   HIDS runs on host, and basically designed to monitor, detect and respond to user and attack. Some robust HIDS also include audit policy management and centralization, supply data forensics, statistical analysis and evidentiary support, and in certain instances provide some measure of access control. Once classic example of HIDS product is Tripwire.

3. Hybrid Intrusion Detection.
   Hybrid intrusion detection on the other hand is basically combination of best features of both network and host-based intrusion detection devices with addition of centralize management. Hybrid solutions provide the logical complement to NID and HID which is a central intrusion detection management. Because of this, hybrid is the best solution for enterprise level deployment of IDS. [17]

While IDS is designed only to detect attacks, IDS products such as Snort and RealSecure also equipped with simple prevention component called active-response capabilities by sending TCP Resets packet to stop the attack. Even though this is not really efficient, but this type of reactive defense feature that started the evolution of Intrusion Prevention technology.

The Need for Intrusion Analysts

Intrusion Detection deployment does not stop an attack nor will react to validate alerts on events detected and takes action to stop it. Instead, the critical part of analyzing, validating alerts and takes action to modify or inform people responsible to modify

firewall policies to block attack, can only be done by Intrusion Analysts. It will not work by having IDS deployed and being left alone to do its work. Having a highly skilled Intrusion Analysts is critical in greatly increase the chances of catching malicious activities, virus, worm and other exploits, thus protecting your environment.

Joel Snyder summarized some important points to keep in mind. First, an IDS is only as good as its configuration. IDS need to know everything about your network before something is a false positive or it is a real attack. Information such as port numbers used by HTTP server, need to be configured in IDS so that it will look at the right place. For example, if web server is running port 80 and port 8008, IDS will only recognize port 80 to be valid HTTP traffic, and detected port 8008 traffic as an attack. Thorough audit in of your network should be done for Intrusion Analyst to reconfigure IDS.

Secondly, IDSes are dumb. You have to tell them everything or you will be saturated with false positive alerts. Even if you tell them everything, you will still find IDSes are always one step or two behind the latest attack. IDS products currently available in market do not use artificial intelligence or neural networks, but they look for patterns that match known problems which is signature based IDS. Even for protocol anomaly based IDS, they are matching network traffic with RFCs and normal traffic pattern, thus still producing false positives even though not as many as signature based IDS. As result, highly skilled intrusion analysts are the best asset to fine-tune the IDSes, updating signatures and reducing false positives while at the same time balancing the need of keeping valid attacks and suspicious traffics.

Third, you need to know a lot of details. Each IDS product operates differently, depending if the product is doing stateful matching, context matching, protocol anomaly or pattern searching. All of these have to be considered, in addition to different level of detail perform by IDS products. All of these are based on TCP/IP protocols, thus Intrusion Analysts are expected to know the ins and outs of TCP/IP.

Fourth, you need be prepared to spend a lot of time and money. Freeware IDS does not mean it ends there after the IDS have been installed and configured. However IDS requires time and money to be administered and managed on daily basis. Intrusion Analysts have to continuously analyze alerts produced, take action for valid attacks and reducing false positives.

Fifth is marketing features versus reality of these IDS products. Be sure to evaluate the risks and rewards of newer features that look useful at first, such as active attack evasion. Some of these features seem less than perfect when examined closely by Intrusion Analysts. [16]

FIGURE 5: **Security Certification Bonuses**

SECURITY CERTIFICATIONS	MEDIAN % of Base Salary Q1 '02	ANNUAL % Growth Q1 '01–Q1 '02
GIAC Certified Intrusion Analyst (GCIA)	12%	50%
GIAC Certified Incident Handler (GCIH)	10%	N/A
GIAC Certified Firewall Analyst (GCFW)	9%	29%
Certified Information Systems Security Professional (CISSP)	9%	29%
GIAC Systems and Network Auditor (GSNA)	8%	N/A
Certified Information Systems Auditor (CISA)	8%	-20%
GIAC Certified Unix Security Administrator (GCUX)	8%	33%
GIAC Certified Windows Security Administrator (GCWN)	8%	60%
Certified Network Security Professional (CNSP)	7%	17%
GIAC Security Essentials Certification (GSEC)	6%	N/A

Source: Foote Partners LLC

Figure 1: [10]

Interestingly enough, David Foote from Infosecuritymag.com in his survey found out that Intrusion Detection field is one of the most demanded skills in Information Security. The Figure 1 above showed that GIAC Certified Intrusion Analyst is the second highest growth of 50 percent in demand between year of 2001 and 2002. [10]

Evolution to Intrusion Prevention System

Interesting new technology has emerged in the information security world called Intrusion Prevention System (IPS). It is not a product, but instead it is a technology, which supposedly combined the best of firewall and Intrusion Detection world. [1] While firewall protection is more static according to fixed policies, whether at Link layer or up to Application layer for proxy firewall, firewall lacks of intelligence to detect new attacks and dynamically block the attack. From simple reactive-response capabilities in Intrusion Detection that simply send TCP Reset to attacker to stop UDP flood attack, Intrusion Prevention has evolved to more intelligent and dynamic in detecting and stopping attacks.

The first generation of IPS was not that smart that it would block an attack essentially by adding a firewall rule, blocking all traffics from a hostile IP address. That's fine, until false positives started causing more legitimate traffics being blocked and creating denial of service to itself.

The second-generation of IPS however, operates in a more elegant fashion in which the offending attack is dropped, but any other connection, even from the same host, are

allowed. While this reduces chances of creating its own Denial of Service, false positives are still big issues. [24] So, even in IPS space, intrusion analysts are still needed to remove false positives and to verify traffics being blocked are real attacks.

Intrusion Prevention System Products

Similar to IDS products, IPS products can also divided to two categories, Host Intrusion Prevention Systems (HIPS) and Network Intrusion Prevention Systems (NIPS).

HIPS – One such product is Entercept Intrusion Prevention System (www.entercept.com) that has three separate products for specialized protection that is Entercept Standard Edition, Entercept Web Server Edition and Entercept Database Edition.

Entercept IPS proactively protects servers and applications from attacks that can not be block using firewall such as buffer overflows and worms. Entercept can protect servers from both known and unknown malicious attacks. The method used by Entercept to protect host is by evaluating requests to the operating system before they are processed. Combination of both behavioral rules and signatures are used to detect and prevent both known and unknown attacks.

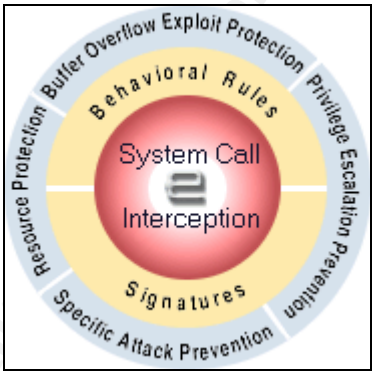


Figure 1 [60]

Two main component of Entercept is Entercept Agent, installed on each server and Entercept Console for management, review and reporting. Entercept Agents intercept system calls to the operating systems and if calls determined to be malicious in behavior, will then get blocked. Among other things, Entercept determines the process making the call, the user making the call, the resource being accessed by the call, and the user permissions related to the call. This information is then matched against appropriate behavioral rules and signatures. Calls that attempt malicious behavior or match any specific rules are then blocked. These preventive activities are logged to the Entercept Console for review and reporting.

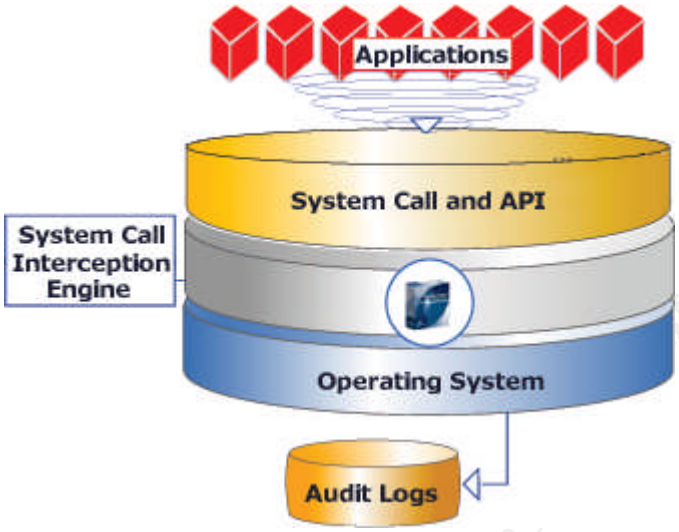


Figure 2: Entercept resides on the server, protecting the operating system and applications [61]

NIPS – Commercial products available are like IntruShield 4000 and IntruShield 2600 from Intruvert (www.intruvert.com) and Attack Mitigator IPS from Toplayer (www.toplayer.com); while freeware under OpenSource available are Hogwash (http://hogwash.sourceforge.net/) and Snort-Inline (http://www.snort.org/dl/contrib/patches/inline/) even though Snort-inline is build more towards honeypot concept.

Intruvert for example, has two products available, IntruShield 4000 for enterprise networks and IntruShield 2600 for mid-to-large networks. According to Intruvert, these two sensors deliver real-time network intrusion detection and prevention solution with features listed below:

- Intrusion Intelligence™: Unprecedented capabilities provide detailed, accurate and reliable information related to intrusion identification, relevancy, direction, impact and analysis.
- Virtual IDS: Powerful capability to enforce multiple, highly granular, custom intrusion policies within a single sensor.
- Comprehensive Intrusion Detection: Intelligent detection of known, first-strike, and DoS attacks using a combination of signature, anomaly, and DoS detection techniques.
- Flexible Deployment: Unprecedented flexibility of IDS deployment—including in-line, full-duplex tap, and SPAN modes—to suit any network security architecture.
- Real-time Intrusion Prevention: Proactive capability to stop in-progress attacks coupled with a rich set of automated and user-initiated alerting and response actions.
- Multi-gigabit Performance: Powered by purpose-built hardware that is capable of delivering multi-gigabit performance.

- Automated Real-time Threat Updates: Innovative, automated process delivers real-time, enterprise-wide signature updates without requiring sensor reboots, and provides protection against newly discovered attacks while eliminating manual updates and sensor downtime.
    - Interoperability: Works with leading firewalls, enterprise management applications and Security Information Management (SIM) applications to offer reduced total cost of ownership. [59]

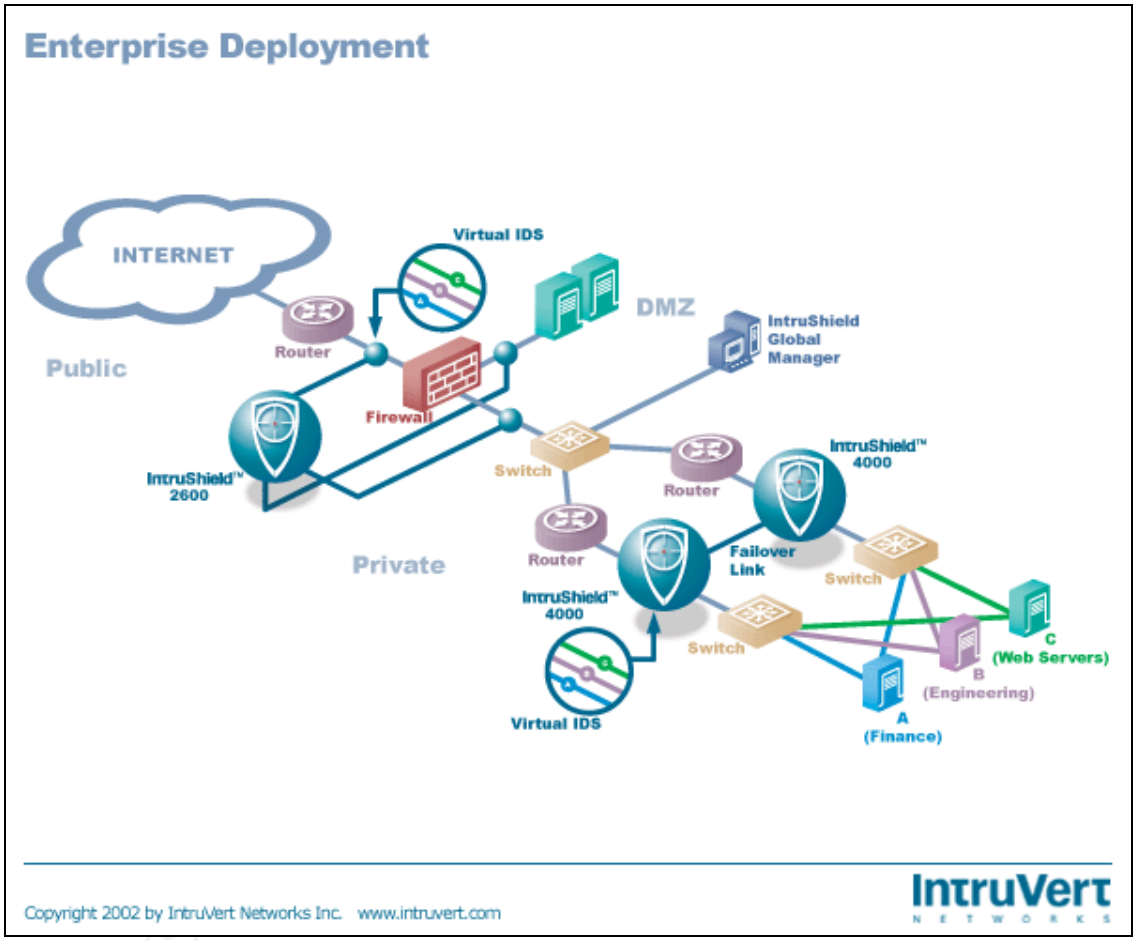


Figure3: Intruvert Enterprise Deployment [58]

Best Practices of IPS Deployment

Any organization that intends to protect itself by using Intrusion Prevention technology, should take a number of factors that address its security requirements into consideration. Best practice should include:

1. **Host-based protection**. Securing at network level is a major challenge. The best place to enforce security is at the desktops and servers, where actual work is done and the potential for damage is greatest.
2. **Real-time prevention decisions**. This is to ensure the highest level of security and minimize the ability to bypass security policy on host. Effective IPS strategy in preventing violation in real time is a major challenge.

3. **Defense in depth – protection from attack from various places**. Attacks usually has multiple phases such as exploiting network and application-level weaknesses, replicating and distributing themselves, and making unauthorized changes. Intrusion Prevention must protect systems from all phases. This is another major challenge for IPS.
4. **Real-time correlation at the agent and enterprise level**. Taken from IDS technology, correlation is vital for effective IPS technology and provides a level of accuracy on prevention decisions that is not covered with signature-based approaches. Even in the IDS worlds, correlation is a challenging task in reducing false positives.
5. **Behavioral approach**. For Intrusion prevention to be proactive, it must enforce appropriate system and application behavior. Dependency on protocol anomaly and signatures is inadequate.
6. **Flexibility to meet unique corporate needs.** Intrusion Prevention solution must be flexible to the unique needs of every corporation in how it configures and manages its systems and applications.
7. **Ease of deployment.** Deployment should minimize personnel overhead in agent deployments, with out-of the-box functionalities, and allow for new and custom policies to be rolled out as needed.
8. **Centralized event management.** All events generated by agents must roll up into a centralized repository from which alerts and reports may be generated. This is a must for corporate level deployment.
9. **Platform coverage, with support from desktops and servers.** Solution must include coverage for the key operating systems that corporation wishes to protect.
10. **Administration.** Policy management can be accomplished from central point and can be automatically distributed to agents on a configurable interval. Policies must also be exportable for replication and archive purposes. [25]

Above best practices can be used as guidelines in choosing Intrusion Prevention products, however, spending the time in testing the product themselves is certainly the best way in establishing a truly deep understanding of the product. [44]

IDS in Future of IPS World

Intrusion Prevention is certainly not Intrusion Detection due IDS's biggest asset that is the Intrusion Analyst who can make sound analysis and judgment on attacks detected. Marty Roesch laid out two scenarios that illustrate why Intrusion Prevention is unlikely to replace IDS:

1. IPS devices only guard the peering points (at best) of network. IN the case of an attack between hosts on the same broadcast network (inside the peering point) you have absolutely no coverage from the IPS. In that case you'll need to have an IDS to tell you what's going on. For example, someone in engineering decides to give him self a raise by hacking into the accounting department and making it so, your IPS has no visibility into this traffic so it's quite worthless. You IDS can see this traffic, however, and collect the relevant information for detection/enforcement of policy and evidence for law enforcement.

2. No IPS is going to be perfect, so attacks are going to slip through them. It can be attacks that they don't know about (new buffer overflows, etc) or even traffic that's legitimate but hostile in your environment, like non-anonymous logins to your anonymous FTP server. If an attack gets by an IDS, how will you know? You better have pretty good IDS to tell you, that's how. [42]

One of IPS's biggest problem is that it is lacking the artificial intelligent (AI) or "logic" to determine false positives. [45] Toby Kohlenberg brought up similar question that is, "how have you validated that you have a false-positive rate that approaches zero and how would I tune the box to ensure it will never cut off legitimate traffic?" [49] This problem can become a great risk of creating its own Denial of Service by actively blocking legitimate traffic in the network.

Conclusion

The evolution of Intrusion Prevention technology certainly adds another layer of security for better protecting corporate network and hosts. For security professionals, Intrusion Prevention complements current security technology already in place such as firewalls and intrusion detection technology, rather than replaces them. In addition, Marty Roesch stated, "I believe IPS to be more of a threat to (or the future of) firewalls." "Intrusion detection devices have a VERY different role in the network security hierarchy, they provide "awareness" of that's happening on your network, verification of policy compliance and detection of potential threats and anomalies". [42]

References:

1. Snyder, Joel PhD.; "IPS: A Technology, not a product"; Network World; 11/25/02 http://www.nwfusion.com/columnists/2002/1125snyder.html
2. Lindstrom, Pete; "Guide to Intrusion Prevention"; Information Security; October 2002; http://www.infosecuritymag.com/2002/oct/sidebar.shtml
3. Roundtable – "IDS in the trenches"; September 2002; http://www.infosecuritymag.com/2002/sep/roundtable.shtml
4. Roundtable – "IDS at the crossroads"; June 2002; http://www.infosecuritymag.com/2002/jun/cover.shtml
5. Mackey, Richard; "Security Architecture: Layered Insecurity"; June 2002; http://www.infosecuritymag.com/2002/jun/insecurity.shtml
6. Briney, Andy; "What isn't Intrusion Prevention"; April 2002; http://www.infosecuritymag.com/2002/apr/note.shtml
7. Briney, Andy; "Next steps for IDSes"; May 2002; http://www.infosecuritymag.com/2002/may/note.shtml

8. Heiser, Jay; "Misguided Thinking: 5 misconceptions continue to hamper overall security"; November 2002; http://www.infosecuritymag.com/2002/nov/curmudgeon.shtml
9. Bobbitt, Mike; "Inhospitable host: Attacker may try the door, but intrusion prevention tools won't let them in"; October 2002; http://www.infosecuritymag.com/2002/oct/cover.shtml
10. Foote, David; "Security still pays"; August 2002; http://www.infosecuritymag.com/2002/aug/securitymarket.shtml
11. Skoudis, Edward; "Cracker tools and techniques: Faster, Stealthier… More dangerous"; July 2002; http://www.infosecuritymag.com/2002/jul/faster.shtml
12. Ferrell, Robert G.; "Security Freeware: Making sense of firewalls"; June 2002; http://www.infosecuritymag.com/2002/jun/makingsense.shtml
13. Avolio, Fred; "Practical Firewalling"; June 2002; http://www.infosecuritymag.com/2002/jun/basics.shtml
14. Harley, David; "Virus Trends: The future of malicious code"; May 2002; http://www.infosecuritymag.com/2002/may/maliciouscode.shtml
15. Bobbitt, Mike; "Web Security: Bulletproof"; May 2002; http://www.infosecuritymag.com/2002/may/bulletproof.shtml
16. Snyder, Joel; "Everything you need to know about IDSes"; Network World; 04/08/02; http://www.nwfusion.com/columnists/2002/0408snyder.html
17. Innella, Paul; "The Evolution of Intrusion Detection Systems"; Tetrad Digital Integrity, LLC; November 16 2001; http://online.securityfocus.com/infocus/1514
18. Newman, David; Snyder, Joel; Thayer, Rodney; "Crying Wolf: False alarm hide attacks"; Network World; 06/24/02: http://www.nwfusion.com/techinsider/2002/0624security1.html
19. IDS Glossary; Network World; 06/24/02; http://www.nwfusion.com/techinsider/2002/0624security2.html
20. Snyder, Joel; "Three tips for reducing false alarms"; Network World; 06/24/02 http://www.nwfusion.com/techinsider/2002/0624security3.html
21. "Attack we performed and performance of IDS products tested"; Network World; 10/08/01; http://www.nwfusion.com/reviews/2001/1008revside1.html
22. Whitepaper; "Beyond IDS: Essentials of Network Intrusion Prevention"; Top Layer; http://www.toplayer.com/bitpipe/IPS_Whitepaper_112602.pdf
23. Cummings, Joanne; "From Intrusion Detection to Intrusion Prevention"; Network World; 09/23/02; http://www.nwfusion.com/buzz/2002/intruder.html
24. DeShon, Marcus, PhD; "Intrusion Prevention versus Intrusion Detection"; http://www.secureworks.net/techResourceCenter/fullTechArticle.php?article=IpsVsIds
25. "Technology Best Practices For Intrusion Prevention"; OKENA, Inc.; Jan 1 2002; http://www.okena.com/pdf/IP%20Best%20Practices.pdf

26. Whitepaper; “Intrusion Detection and Prevention: Protecting Your Network from Attacks Allowed By The Firewall”; OneSecure™ Inc.; http://www.securitytechnet.com/resource/security/ids/idp-whitepaper.pdf
27. Whitepaper; “Intrusion Detection and Prevention”; OneSecure™ Inc.; 2001; http://www.securitytechnet.com/resource/security/ids/OneSecure_IDP_Datasheet.pdf
28. Hammond, David; “New Approach To Intrusion Detection: Intrusion Prevention”; November 2001; http://www.scmagazine.com/scmagazine/sc-online/2001/article/049/article.html
29. Hollander, Yona; “Intrusion Prevention: Why Simple Detection Doesn’t Cut It Anymore”; August 2001: http://www.scmagazine.com/scmagazine/sc-online/2001/article/030/article.html
30. Dunigan, Tom; Hinkel, Greg; “Intrusion Detection and Intrusion Prevention on a Large Network. A Case Study”; Oak Ridge National Laboratory; http://www.usenix.org/publications/library/proceedings/detection99/full_papers/dunigan/dunigan_html/index.html
31. Abene, Mark; Kovacich, Greald L.; Lutz, Steven; “Intrusion Detection Provides A Pound of Prevention”; Page 1-6 http://www.networkcomputing.com/815/815ws1.html
32. Graphics; “Network Security Hot Spots”; http://img.cmpnet.com/nc/815/graphics/hotspots.pdf
33. Wang, Feihi; “Vulnerability Analysis, Intrusion Prevention and Detection for Link State Routing Protocols”; 2000 http://www.cs.ucdavis.edu/~wu/publications/fwphd.pdf
34. Taylor, Laura; “**Intrusion detection is not intrusion prevention**”; TechRepublic; 22 August 2002; http://www.zdnet.com.au/itmanager/technology/story/0,2000029587,20267597,00.htm
35. Conz, James; “The Next Security Software? Introduction of http://www.giac.org/practical/James_Conz_GCIA.doc
36. Ellis, Joe; “Intrusion Detection Systems: Component architecture” http://www.giac.org/practical/Joe_Ellis_GCIA.doc
37. Schultise, Jeff; http://www.giac.org/practical/jeff_schultise_GSEC.doc
38. Rudzonis, Brian; “Intrusion Prevention: Does it measure up to the hype?” http://www.giac.org/practical/Brian_Rudzonis_GSEC.doc
39. Terry, Patrick; “Intrusion Detecion is becoming re-created as Intrusion Prevention” http://www.giac.org/practical/Patrick_Terry_GSEC.doc
40. History of Firewalls; Copyright 2001 Anti-Hack; http://dmsweb.badm.sc.edu/mgsc890/firewalls/fire2.htm
41. Allen, Julia; Christie, Alan; Fithen, William; McHugh, John; Pickel, Jed; Stoner, Ed; “State of the Practice of Intrusion Detection Technologies”; January 2000; Technical Report; Carnegie Mellon, Software Engineering Institute; http://www.cert.org/archive/pdf/99tr028.pdf

42. Roesch, Marty; "[Snort-users] New Trend: Intrusion Prevention"; Email snort-users@list.sourceforge.net; Friday, Dec 13 2002
43. Gonzalez, Alberto; "[Snort-users] New Trend: Intrusion Prevention"; Email snort-users@lists.sourceforge.net; Friday, Dec 13, 2002
44. Ranum, Marcus J,; "OSEC [WAS: Re: Intrusion Prevention]"; Email focus-ids@securityfocus.com; Monday, Dec 30 2002
45. Lo, Roy; "Re: Intrusion Prevention"; Email focus-ids@securityfocus.com; Thursday, Oct 31 2002
46. Plato, Andrew; "Re: Intrusion Prevention Systems"; Email focus-ids@securityfocus.com; Wednesday, Oct 30 2002
47. Williams, Rick; "Re: Intrusion Prevention"; Email focus-ids@securityfocus.com; Wednesday, Dec 25 2002
48. Kohlenberg, Toby; "Re: IDS responses"; Email focus-ids@securityfocus.com; Monday, Nov 18 2002
49. Kohlenberg, Toby; "Re: Changes in IDS Companies"; Email focus-ids@securityfocus.com; Thursday, Act 31 2002
50. Plato, Andrew; "Intrusion Prevention System"; Email focus-ids@securityfocus.com; Monday, Oct 28 2002
51. Andy; "H/N IPS –what is there?"; Taliskers Network Security Tools; Email focus-ids@securityfocus.com; Wednesday, Dec 11 2002
52. Bakos, George; "FW: Missing admin sql password in Okena Stormwatch"; Email intrusions@incidents.org; Wednesday, Dec 18 2002
53. Ranum, Marcus J; Curtin, Matt; Internet Firewalls: Frequent Asked Questions; http://www.interhack.net/pubs/fwfaq/#SECTION00031000000000000000
54. Intrusion Detection FAQ; How do you implement IDS (network based) in a heavily switched environment; http://www.sans.org/resources/idfaq/switched.php
55. F5 Networks; BIGIP; http://www.f5.com/solutions/applications/terminal_ab/terminal_server_ab.pdf
56. Sourcefire; Product: Sourcefire Intrusion Management System; http://www.sourcefire.com/products/products.htm
57. Entercept; Product Overview; http://www.entercept.com/products/
58. Intruvert; Intrusion Prevention System; Enterprise Deployment; http://www.intruvert.com/products/images/600-enterprise-deployment-with-vids.gif
59. Intruvert; IntruShield Network IDS Sensors; http://www.intruvert.com/products/sensors.htm
60. Entercept; Entercept Standard Edition; http://www.entercept.com/products/entercept/index.asp
61. Entercept; How Entercept Works; http://www.entercept.com/products/entercept/prodinfo/overview.asp

Assignment #2: Detect 1 : MISC Source Port 20 to <1024"

P	Signature	Classification	Type	Source	Destination	Sensor	Time Stamp »
2	MISC Source Port 20 to <1024	bad-unknown	TCP	216.189.121.3:20	32.245.146.122:80	Sensor01	1:38 PM - 10/16

12:38:00.796507 216.189.121.3.20 > 32.245.146.122.80: S 2489891814:2489891814(0) win 16384 <mss 1460,nop,nop,sackOK> (DF) (ttl 109, id 5840, bad cksum dcaf!)

1. **Source of Trace**

   The source of this trace from the log provided by GIAC at http://www.incidents.org/logs/Raw/2002.9.1

2. **Detect Was Generated By:**

   Initially, to ease my search for interesting detects, I used Demarc PureSecure [http://www.demarc.com] and I ran snort with the command below against the RAW files provided at http://www.incidents.org/logs/Raw to upload the alerts into MySQL database. I disabled preprocessor stream4 and preprocessor stream4_reassemble and got better result than default configuration. Thanks to Daniel Wesemann who brought this up in intrusions@incidents.org list.

   snort -p -l C:\PureSecure\sensor\logs -r C:\PureSecure\sensor\logs_raw\2002.9.1 -c C:\PureSecure\sensor\conf\snort4.conf

   I used all files listed below:

2002.9.1	2002.9.2	2002.9.3	2002.9.9	2002.9.10
2002.9.11	2002.9.12	2002.9.13	2002.9.14	2002.9.15
2002.9.16	2002.9.17	2002.9.18	2002.9.19	2002.9.20
2002.9.21	2002.9.22	2002.9.23	2002.9.24	2002.9.25
2002.9.26	2002.9.27	2002.9.28	2002.9.29	2002.9.30
2002.9.31	2002.10.1	2002.10.2	2002.10.3	2002.10.4
2002.10.5	2002.10.6	2002.10.7	2002.10.8	2002.10.9
2002.10.10	2002.10.11	2002.10.12	2002.10.13	2002.10.14
2002.10.15	2002.10.16	2002.10.17	2002.10.18	

   In this particular detect, this event was detected from file 2002.9.16. Looking at the date on detect, however, showed discrepancy between the file name 2002.9.16 with time stamp of 2002-10-16 13:38:00.

   Below is the detect with priority 2 shown on my Demarc PureSecure webpage:

Signature Information			
Signature	**Sensor**	**Event ID**	**Time Stamp**
MISC Source Port 20 to <1024 - Find in Rules	Sensor01 (1)	66424	2002-10-16 13:38:00
Classification Description	**Priority**	**Classification**	**Time Since Event**
Potentially Bad Traffic	2	bad-unknown	93 dy 7 hr 58 min 55 sec Ago

Basic Information							
Src IP	Src Host	Src Port	Src Service	Dst IP	Dst Host	Dst Port	Dst Service
216.189.121.3	-	20	ftp-data	32.245.146.122	-	80	http
Whois :: Trace :: Ping :: DNS				Whois :: Trace :: Ping :: DNS			

IP Information								
Ver	Hlen	TOS	Length	ID	Flags	Offset	Chksum	TTL
4	5	-	48	5840	-	-	56495	109

TCP Information							
Seq	Ack	Urp	Res	Win	Flags	Offset	Chksum
2489891814	-	-	-	16384	S	7	55331

Which is triggered by snort rule version 1.90 as below:

alert tcp $EXTERNAL_NET 20 -> $HOME_NET :1023 (msg:"MISC Source Port 20 to <1024"; flags:S; reference:arachnids,06; classtype:bad-unknown; sid:503; rev:2;)

Then, I used windump to find this particular detect as below:

```
C:\>windump -r 2002.9.16 -vv -X "src 216.189.121.3"
12:38:00.796507 216.189.121.3.20 > 32.245.146.122.80: S 2489891814:2489891814(0) win 16384
<mss 1460,nop,nop,sackOK> (DF) (ttl 109, id 5840, bad cksum dcaf!)
0x0000   4500 0030 16d0 4000 6d06 dcaf d8bd 7903        E..0..@.m.....y.
0x0010   20f5 927a 0014 0050 9468 bbe6 0000 0000        ...z...P.h......
0x0020   7002 4000 d823 0000 0204 05b4 0101 0402        p.@..#..........
```

3. **Probability the Source Address Was Spoofed**

It is less likely that the source address was spoofed due to the fact that this TCP connection requires completed TCP three-way-handshake i.e. (SYN, SYN-ACK, ACK) for connection to be established. Even though only SYN packet was detected from 216.189.121.3 targeting 32.245.146.122, other SYN-ACK and ACK packets might have been passed undetected due to fact that snort rules are not configured to capture them. The attacker could also play man-in-the-middle to listen for responses of its spoofed source address, but this would be difficult to achieve. Therefore, very high probability that source address is not spoofed.
Bad packet checksum showed was probably resulted from sanitize work done by SANS on the raw files.

Question:

> From: Smith, Donald [Donald.Smith@qwest.com]
> Sent: Wednesday, January 29, 2003 8:09 AM
> To: 'Mohammed Haron'; intrusions@incidents.org
> Subject: RE: LOGS: GIAC GCIA Version 3.3 Practical Detect (MHaron)
>
> Can you be sure the source address ISNT spoofed if you see a three way

handshake?

> man-in-the-middle to listen for response to this attack.

Ok that would be one way to spoof and still get results.
Any others you can think of?

Answer:
Donald is correct. Another possibility is that the three-way-handshake was completed, but "hidden" and not captured because the default snort rule is only capturing the initial packet with "S" flag set. This, in this case, source is not been spoofed.

4. **Description of Attack**

This attack attempted to establish TCP session to port 80 on a host 32.245.146.122 using active ftp port 20. This could be a scan to see if web service is running on target or a beginning of an attack if target is known to be vulnerable. There is known vulnerability on Cisco 600 series routers running CBOS (Cisco Broadband Operating System) version 2.4.2ap and earlier that vulnerable to denial of service attack caused by a vulnerability in the web-based configuration utility. The web-based utility by default is bind to port 80, even if this service has been disabled. This vulnerability allows remote attacker to send multiple HTTP connection request that cause the router to stop responding or allow any traffic to pass.

5. **Attack Mechanism**

This attack is targeted to host usually located behind firewall. The attack was attempting to establish active ftp session to port 80 for http service on the target host. In regular passive FTP session, client host will initiate a FTP connection using from ephemeral port (ports above 1024) to port 21 which is default ftp port on a ftp server. Then during this session, authentication occurs between the client and the server host. When the client request a data connection used for file transfer, the client will issue PORT command to the server host with parameters such as IP address and port number to connect to. The server host will then open a connection on port 20 (known as FTP Data Port) to client's specified IP address and port information to send data to.

In this attack however, utilizing active ftp, the attacker is initiating a connection to target host. Then, attacker can listen for the FTP replies from the target host. The 3-digit numbers replies can give specific meaning such as shown below:

Reply Number	Meaning
125	Data connection already open; transfer starting
200	Command OK
425	Can't open data connection

These information are valuable for attacker to plan the next attack.

6. **Correlations**

Scott Shinberg [4] discussed this active ftp attack in his GCIA practical paper that source port 20 was used to get through firewall. Since TCP connection for active ftp requires that TCP is initiated from the ftp server to the client for sending data, this attempt might pass the firewall. Regular ftp session of the ftp client to send ftp command to ftp server on port 21 in regular FTP session.

Phil Wood [9] also suggested that there are possibilities that the rule used in this case, generated a lot of false positive from operating systems with broken IP stack. However, if we would expect false positive from operating systems with broken IP stack, we would expect a lot of similar events to be generated.

A snortsnarf IDS log at http://openbsd.agero.se/snort/sig/sig20.html also shown attacks detected by same rule. These events utilizing same attack mechanism, but targeting port 25 for mail service. Only one alert generated for each attempt.

7. **Evidence of Active Targeting.**

It is pretty clear that this attack is targeted to 32.245.146.122 from source IP 216.189.121.3. To know more about the source host, I used a tool called Netcraft at http://www.netcraft.com to determine if source host is running any web service. The result is shown below:
" The site 216.189.121.3 is running **Microsoft-IIS/5.0** on **Windows 2000"**

The fact that this source host is running a web service attempting to connect to target host on port 80 is not a good sign. Especially, source host is attempting to initiate TCP connection via active ftp is further proof that this is active targeting. It would be difficult to determine whether this attack was successful or not without additional alerts. This could also be a super slow scan to see a response from port 80 and if the IP is spoofed, man-in-the-middle could have played a role in catching the response.

Question:

> From: Bryce_Alexander@Vanguard.com
> Sent: Wednesday, January 29, 2003 9:22 AM
> To: Mohammed Haron
> Cc: intrusions@incidents.org
> Subject: Re: LOGS: GIAC GCIA Version 3.3 Practical Detect (MHaron)
>
> You mentioned that you did not see any additional traffic from the source IP and assumed that this indicated an unsuccessful attack. Keep in mind that the logs only contain information that matched some kind of

signature. Could the rest of the traffic simply not matched any signature and therefore could have been present, but not logged?
How many SYN frames do you usually see when the TCP connection is blocked by a firewall or filter (assume it is not crafted)?

Answer:
Bryce is correct. Due to raw files produced with "S" flag set, other packet related to this packet {SYN-ACK, ACK) is then "hidden" and not captured.

Question:

From: Robert Wagner [rwagner@eruces.com]
Sent: Wednesday, January 29, 2003 5:57 AM
To: 'Mohammed Haron'; intrusions@incidents.org
Subject: RE: LOGS: GIAC GCIA Version 3.3 Practical Detect (MHaron)

What is the purpose of the attack? Criticality - Are there any known vulnerablities with web servers answering requests coming from a priviledged port? If not, then is this just a simple scan looking for web servers?

Answer:
This is most probably a scan. However, there is a known vulnerability as listed on CAN-2001-1065 on Cisco router. The web-based configuration utility in cisco 600 series routers running CBOS 2.0.1 through 2.4.2ap bind itself to port 80 even when web-based configuration services are disabled, which could leave the router open to attack.

8. **Severity**

Severity is calculated using formula:

Severity = (Criticality + Lethality) – (System Countermeasures + Network Countermeasures)

With each elements worth 1 to 5 points where 1 is the least and 5 is the highest.

Criticality: Since the attacker is targeting port 80 on a specific IP address, this is probably a web server that the attacker has obtained its IP address. So, I gave 3 points.

Lethality: This attack is used to bypass the firewall packet filter. Even though this might open to other attack, this particular attack by itself is not lethal. This could be a scan for future attack. So, I gave 2 points.

System Countermeasures: Since, there was no respond detected from the targeted IP (at least with the undetermined rules used to produce the raw file), I assumed the target IP is quite secure. So, I gave 2 points.

Network Countermeasures: Due to unknown network and the nature of this attack to bypass a firewall, I suspect that the network has some perimeter of defense in place. So, I gave 2 points.

Therefore:
Severity = (3+2)-(2+2) = 1

9. **Defensive Recommendation**

Stateful firewall should be installed that will be able to inspect the content of a packet, as additional defense on top on non-stateful firewall already in place. Routers should be scanned for vulnerabilities and if Cisco 600 series router is use, and running CBOS version 2.4.2ap or earlier, the software will need to be upgraded to version 2.4.2b or higher. Detail information is available at http://www.cisco.com/warp/public/707/cisco-cbos-webserver-pub.shtml.

10. **Multiple Choice Test Question**

Please refer to this Snort Rule below and answer the question:

misc.rules:alert tcp $EXTERNAL_NET 20 -> $HOME_NET :1023 (msg:"MISC Source Port 20 to <1024"; flags:S; reference:arachnids,06; classtype:bad-unknown; sid:503; rev:1;)

From the Snort rule above, which one below will not generate any event?
A) 216.189.121.3.20 > 32.245.146.122.1023: **SAck** 2489891814:2489891814(0) win 1638
B) 216.189.121.3.20 > 32.245.146.122.1023: **S** 2489891814:2489891814(0) win 1638
C) 216.189.121.3.20 > 32.245.146.122.80: **Ack** 2489891814:2489891814(0) win 1638
D) 216.189.121.3.20 > 32.245.146.122.80: **SF** 2489891814:2489891814(0) win 1638

Answer: C.

References:

1) Whitehats.com; “IDS6 “SOURCEPORTTRAFFIC-20-TCP” http://www.whitehats.com/cgi/arachNIDS/Show?_id=ids6&view=research

2) Maxwell, Mike; “Slow and steady ftp probes”; http://www.incidents.org/archives/intrusions/msg03533.html
3) CAN-2001-1065; http://cve.mitre.org/cgi-bin/cvename.cgi?name=CAN-2001-1065
4) Shinberg, Scott; GCIA Certification - Practical Assignment; http://www.giac.org/practical/Scott_Shinberg_GCIA.doc
5) Lam, Jason; GCIA Certification – Practical Assignment; http://www.giac.org/practical/Jason_Lam_GCIA.doc
6) Cisco Security Advisory: CBOS Web-based Configuration Utility Vulnerability; http://www.cisco.com/warp/public/707/cisco-cbos-webserver-pub.shtml
7) ISS X-Force Database; cisco-cbos-web-config (7027); http://www.iss.net/security_center/static/7027.php
8) Netcraft; http://www.netcraft.com
9) Wood, Phil; Snort-Users mailinglist; http://archives.neohapsis.com/archives/snort/2001-06/0444.html
10) Snortsnarf signature page; MISC Source Port 20 to <1024; http://openbsd.agero.se/snort/sig/sig20.html
11) Stevens, Richard W; TCP/IP Illustrated Volume 1, The Protocols; Nov 2001

2.2 Assignment #2: Detect 2: WEB-MISC cisco /%% DOS attempt

08:16:49.626507 207.166.87.157.64785 > 66.54.32.235.80: P 3447537467:3447538164(697) ack 502420461 win 64860 (DF) (ttl 124, id 7952, bad cksum 9cec!)

4500 02e1 1f10 4000 7c06 9cec cfa6 579d	E.....@.|.....W.
4236 20eb fd11 0050 cd7d 3f3b 1df2 53ed	B6.....P.}?;..S.
5018 fd5c ef9b 0000 4745 5420 2f52 6561	P..\....GET./Rea
6c4d 6564 6961 2f61 6473 2f63 6c69 636b	lMedia/ads/click
5f6c 782e 6367 692f 7777 772e 7573 6174	_lx.cgi/www.usat
6f64 6179 2e63 6f6d 2f73 706f 7274 732f	oday.com/sports/
6d69 6c6b 2f6c 6f61 642e 6874 6d2f 2525	milk/load.htm/%%
5241 4e44 2525 2f53 7065 6369 616c 312f	RAND%%/Special1/
3230 3435 385f 4d69 6c6b 5f53 414d 4d59	20458_Milk_SAMMY
5f32 3030 335f 3239 3835 2f63 6c65 6172	_2003_2985/clear
2e67 6966 2f25 0025 2045 5225 2520 4854	.gif/%.%.ER%%.HT
5450 2f31 2e31 0d0a 4163 6365 7074 3a20	TP/1.1..Accept:.
2a2f 2a0d 0a41 6363 6570 742d 4c61 6e67	*/*..Accept-Lang
7561 6765 3a20 656e 2d75 730d 0a41 6363	uage:.en-us..Acc
6570 742d 456e 636f 6469 6e67 3a20 677a	ept-Encoding:.gz
6970 2c20 6465 666c 6174 650d 0a55 7365	ip,.deflate..Use
722d 4167 656e 743a 204d 6f7a 696c 6c61	r-Agent:.Mozilla
2f34 2e30 2028 636f 6d70 6174 6962 6c65	/4.0.(compatible
3b20 4d53 4945 2035 2e35 3b20 5769 6e64	;.MSIE.5.5;.Wind
6f77 7320 4e54 2035 2e30 290d 0a48 6f73	ows.NT.5.0)..Hos
743a 2061 642e 7573 6174 6f64 6179 2e63	t:.ad.usatoday.c
6f6d 0d0a 436f 6e6e 6563 7469 6f6e 3a20	om..Connection:.
4b65 6570 2d41 6c69 7665 0d0a 436f 6f6b	Keep-Alive..Cook
6965 3a20 5553 4154 494e 464f 3d55 4944	ie:.USATINFO=UID
2533 4461 6138 3133 3237 3833 6438 3837	%3Daa8132783d887
3337 303b 2052 4d49 443d 6161 3831 3332	370;.RMID=aa8132
3738 3364 3838 3863 6130 3b20 5449 443d	783d888ca0;.TID=
3173 3335 3064 6130 7570 6d68 7175 3b20	1s350da0upmhqu;.
4146 4649 4c49 4154 455f 434f 4445 3d75	AFFILIATE_CODE=u
7361 3b20 5645 5254 4943 414c 5f43 4f44	sa;.VERTICAL_COD
453d 6e61 7469 6f6e 616c 3b20 5549 443d	E=national;.UID=
6161 3831 3332 3738 3364 3838 3733 3730	aa8132783d887370
3b20 5444 6174 613d 3b20 7631 7374 3d33	;.TData=;.v1st=3
4444 3237 3938 4130 4432 3039 3135 333b	DD2798A0D209153;
2042 726f 7773 6572 536e 6966 6665 723d	.BrowserSniffer=
6e61 7669 6761 746f 722e 7479 7065 2533	navigator.type%3
4432 2533 4225 3041 6e61 7669 6761 746f	D2%3B%0Anavigato
722e 7665 7273 696f 6e25 3344 352e 3525	r.version%3D5.5%
3342 2530 416e 6176 6967 6174 6f72 2e6f	3B%0Anavigator.o
7325 3344 2532 3225 3230 5769 6e64 6f77	s%3D%22%20Window
7325 3230 4e54 2532 3035 2e30 2532 3925	s%20NT%205.0%29%
3232 2533 4225 3041 6e61 7669 6761 746f	22%3B%0Anavigato
722e 6a73 5665 7273 696f 6e25 3344 312e	r.jsVersion%3D1.
3325 3342 2530 416e 6176 6967 6174 6f72	3%3B%0Anavigator
2e76 6253 6372 6970 7445 6e61 626c 6564	.vbScriptEnabled
2533 4474 7275 6525 3342 2530 410d 0a0d	%3Dtrue%3B%0A...
0a	.

08:16:49.746507 207.166.87.157.64785 > 66.54.32.235.80: P 1349850533:1349851229(696) ack 2945117705 win 64860 [tos 0x10] (ttl 240, id 0, bad cksum 0!)

4510 02e0 0000 0000 f006 0000 cfa6 579d	E.....W.
4236 20eb fd11 0050 1df2 54e0 cd7d 41f5	B6.....P..T..}A.
5018 fd5c 0000 0000 4745 5420 2f52 6561	P..\....GET./Rea
6c4d 6564 6961 2f61 6473 2f63 6c69 636b	lMedia/ads/click
5f6c 782e 6367 692f 7777 772e 7573 6174	_lx.cgi/www.usat
6f64 6179 2e63 6f6d 2f73 706f 7274 732f	oday.com/sports/
6d69 6c6b 2f6c 6f61 642e 6874 6d2f 2525	milk/load.htm/%%

5241 4e44 2525 2f53 7065 6369 616c 312f	RAND%%/Special1/
3230 3435 385f 4d69 6c6b 5f53 414d 4d59	20458_Milk_SAMMY
5f32 3030 335f 3239 3835 2f63 6c65 6172	_2003_2985/clear
2e67 6966 2f25 0025 2045 5225 2520 4854	.gif/%.%.ER%%.HT
5450 2f31 2e31 0d0a 4163 6365 7074 3a20	TP/1.1..Accept:.
2a2f 2a0d 0a41 6363 6570 742d 4c61 6e67	*/*..Accept-Lang
7561 6765 3a20 656e 2d75 730d 0a41 6363	uage:.en-us..Acc
6570 742d 456e 636f 6469 6e67 3a20 677a	ept-Encoding:.gz
6970 2c20 6465 666c 6174 650d 0a55 7365	ip,.deflate..Use
722d 4167 656e 743a 204d 6f7a 696c 6c61	r-Agent:.Mozilla
2f34 2e30 2028 636f 6d70 6174 6962 6c65	/4.0.(compatible
3b20 4d53 4945 2035 2e35 3b20 5769 6e64	;.MSIE.5.5;.Wind
6f77 7320 4e54 2035 2e30 290d 0a48 6f73	ows.NT.5.0)..Hos
743a 2061 642e 7573 6174 6f64 6179 2e63	t:.ad.usatoday.c
6f6d 0d0a 436f 6e6e 6563 7469 6f6e 3a20	om..Connection:.
4b65 6570 2d41 6c69 7665 0d0a 436f 6f6b	Keep-Alive..Cook
6965 3a20 5553 4154 494e 464f 3d55 4944	ie:.USATINFO=UID
2533 4461 6138 3133 3237 3833 6438 3837	%3Daa8132783d887
3337 303b 2052 4d49 443d 6161 3831 3332	370;.RMID=aa8132
3738 3364 3838 3863 6130 3b20 5449 443d	783d888ca0;.TID=
3173 3335 3064 6130 7570 6d68 7175 3b20	1s350da0upmhqu;.
4146 4649 4c49 4154 455f 434f 4445 3d75	AFFILIATE_CODE=u
7361 3b20 5645 5254 4943 414c 5f43 4f44	sa;.VERTICAL_COD
453d 6e61 7469 6f6e 616c 3b20 5549 443d	E=national;.UID=
6161 3831 3332 3738 3364 3838 3733 3730	aa8132783d887370
3b20 5444 6174 613d 3b20 7631 7374 3d33	;.TData=;.v1st=3
4444 3237 3938 4130 4432 3039 3135 333b	DD2798A0D209153;
2042 726f 7773 6572 536e 6966 6665 723d	.BrowserSniffer=
6e61 7669 6761 746f 722e 7479 7065 2533	navigator.type%3
4432 2533 4225 3041 6e61 7669 6761 746f	D2%3B%0Anavigato
722e 7665 7273 696f 6e25 3344 352e 3525	r.version%3D5.5%
3342 2530 416e 6176 6967 6174 6f72 2e6f	3B%0Anavigator.o
7325 3344 2532 3225 3230 5769 6e64 6f77	s%3D%22%20Window
7325 3230 4e54 2532 3035 2e30 2532 3925	s%20NT%205.0%29%
3232 2533 4225 3041 6e61 7669 6761 746f	22%3B%0Anavigato
722e 6a73 5665 7273 696f 6e25 3344 312e	r.jsVersion%3D1.
3325 3342 2530 416e 6176 6967 6174 6f72	3%3B%0Anavigator
2e76 6253 6372 6970 7445 6e61 626c 6564	.vbScriptEnabled
2533 4474 7275 6525 3342 2530 410d 0a0d	%3Dtrue%3B%0A...

1. **Source of Trace**

   The source of this detect is from the logs provided by GIAC at http://www.incidents.org/logs/Raw/2002.10.13

2. **Detect Was Generated By**

   To ease my search for interesting detects, I initially used Demarc PureSecure http://www.demarc.com and I ran snort with the command below against the RAW files provided at http://www.incidents.org/logs/Raw to upload the alerts into MySQL database. I disabled preprocessor stream4 and preprocessor stream4_reassemble to get better result than default configuration, similar to Detect 1 above.

   snort -p -l C:\PureSecure\sensor\logs -r C:\PureSecure\sensor\logs_raw\2002.10.13 -c C:\PureSecure\sensor\conf\snort4.conf

This detect was generated from raw log file 2002.10.13.

1	WEB-MISC cisco /%% DOS attempt	web-application-attack	TCP	207.166.87.157:64785	66.54.32.235:80	Sensor01	8:16 AM - 11/13
1	WEB-MISC cisco /%% DOS attempt	web-application-attack	TCP	207.166.87.157:64785	66.54.32.235:80	Sensor01	8:16 AM - 11/13

Which is triggered by snort rule version 1.90 as below:

alert tcp $EXTERNAL_NET any -> $HTTP_SERVERS $HTTP_PORTS (msg:"WEB-MISC cisco /%% DOS attempt"; flow:to_server,established; uricontent:"/%%"; classtype:web-application-attack; sid:1546; rev:4;)

3. **Probability the Source Address Was Spoofed**

Source address is very unlikely to be spoofed. These two events occurred after TCP three-way-handshake has been completed and TCP connection has been established. After TCP connection has been established, data was sent from source address to target address on port 80 that contained string /%% and triggered this event.

4. Description of Attack

A string of "/%%" was injected in HTTP GET request packet shown in the URL below:
GET./RealMedia/ads/click_lx.cgi/www.usatoday.com/sports/milk/load.htm/%%RAND%%/Special1/20458_Milk_SAMMY_2003_2985/clear.gif/%.%.ER%%

If the target is Cisco router running a vulnerable IOS version, this packet can cause the router to crash. Some routers will automatically reboot, while others will require power cycling to reboot the routers before start routing packets again.

However, these two events detected above determined to be valid HTTP request on web server www.usatoday.com , thus they are false positive.

5. Attack Mechanism

This denial of service attack on Cisco routers configured to run web services for router configurations and other information, that took advantage of vulnerability that exist on some IOS versions. When attacker sends packet that requesting URL in format shown below:

http://<Router IP address>/%%

to the vulnerable routers, these routers can crash, automatically rebooted or requires power cycling to start routing packets again.

Cisco routers running IOS 11.1 through 12.1 and IOS HTTP service running are vulnerable to this attack as covered in CVE-2000-0380. This IOS HTTP server is enabled by default on all Cisco 1003, 1004 and 1005.

However, the events detected above are targeting a web server www.usatodays.com and not a router since a DNS name was used instead of IP address which requires for it to work. Therefore, the above events are false positives.

6. Correlations

Philip Ljunberg in his GIAC GCIA Detect posting to intrusions@incidents.org mailing list, detected 4 events and 2 of them are the same alerts as shown and discussed above. While the other 2 alerts a bit different as shown below:

```
06/07-21:14:44.524488 46.5.180.250:64347 -> 132.235.74.123:80
TCP TTL:124 TOS:0x0 ID:7980 IpLen:20 DgmLen:77 DF
***AP*** Seq: 0xA0E5C06E  Ack: 0xB0E4428  Win: 0x4356  TcpLen: 20
9E 2F 25 25 65 AF 42 EE FF 67 DD 31 F5 3A 3E 00      ./%%e.B..g.1.:>.
01 05 02 0E 00 00 00 CA 18 C0 A8 7B 96 28 03 00      ...........{.(..
00 27 3C 00 00                                       .'<..

=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=

06/07-21:14:44.924488 46.5.180.250:64347 -> 132.235.74.123:80
TCP TTL:124 TOS:0x0 ID:7993 IpLen:20 DgmLen:90 DF
***AP*** Seq: 0xA0E5C7E8  Ack: 0xB0E55D0  Win: 0x4117  TcpLen: 20
3E 97 CE C0 F0 8A EB AC 73 CA B0 D1 2C 9E 54 25      >.......s...,.T%
80 01 06 1B 00 00 00 00 00 61 74 74 61 63 6B 20      .........attack
6F 66 20 74 68 65 20 63 6C 6F 6E 65 73 20 61 76      of the clones av
69 00                                                i.

=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=
```

He determined that this is also false positive that someone is looking for an avi file named “attack of the clones”. This rule could certainly generate a log of false positive.

7. Evidence of Active Targeting

This is not an active targeting since detects has been determined to be false positive. Both events detected were targeted to web server on www.usatodays.com which is not vulnerable to this attack.

8. Severity

Severity is calculated using formula:

Severity = (Criticality + Lethality) – (System Countermeasures + Network

Countermeasures)

With each elements worth 1 to 5 points where 1 is the least and 5 is the highest.

Criticality: Since the attacker is targeting a web server. So, I gave 2 points.

Lethality: This attack can produced DoS, but this incident is false positive. So, I gave 1 point.

System Countermeasures: Assuming web server not vulnerable to this attack and this is a well known website that hopefully quite secure, so I gave 3 points.

Network Countermeasures: Due to unknown network and the nature of this attack, so I gave 1 point.

Severity = (2+1) – (3+1) = -1

In conclusion, this attack is insignificant.

9. **Defensive Recommendation**

No action should be taken since this is false positives. However, vulnerability scan should be done on all Cisco routers in the environment. If Cisco IOS version running is found to be vulnerable, actions need to be taken to secure the routers. IOS web service can be disabled on the router to eliminate this vulnerability. In addition, ACL can be added to prevent access to this HTTP port except for specific host running web server. Permanent solution to this is to patch the router using patch released by Cisco, available at www.cisco.com.

10. **Multiple Choice Test Question**

09:16:49.626507 IP (tos 0x0, ttl 124, id 7952, len 737) 207.166.87.157.64785 > 66.54.32.235.80: P [bad tcp cksum ef9b (->fd81)!] 3447537467:3447538164(697) ack 502420461 win 64860 (DF)bad cksum 9cec (->52a2)!
0x0000 4500 02e1 1f10 4000 7c06 9cec cfa6 579d
0x0010 4236 20eb fd11 0050 cd7d 3f3b 1df2 53ed
0x0020 5018 fd5c ef9b 0000

09:16:49.746507 IP (tos 0x10, ttl 240, id 0, len 736) 207.166.87.157.64785 > 66.54.32.235.80: P [bad tcp cksum 0 (->3d6)!] 1349850533:1349851229(696) ack 2945117705 win 64860bad cksum 0 (->3da3)!
0x0000 4510 02e0 0000 0000 f006 0000 cfa6 579d
0x0010 4236 20eb fd11 0050 1df2 54e0 cd7d 41f5
0x0020 5018 fd5c 0000 0000

Q: What can you tell from detects and header information (in HEX) above?

A) These are TCP packets to establish HTTP connection

B) These are TCP packets pushing data to web server
C) These are UDP packets acknowledging data received from web server
D) These are IP packets acknowledging data received from web server

Answer: B

References:

1- Ljunberg, Phillip;
http://cert.uni-stuttgart.de/archive/intrusions/2002/07/msg00211.html
2- CVE-2000-0380;
http://cve.mitre.org/cgi-bin/cvename.cgi?name=CVE-2000-0380
3- Bugtraq; Cisco IOS HTTP %% Vulnerability;
http://www.securityfocus.com/bid/1154/info/
4- Snort.org;
http://www.snort.org/snort-db/sid.html?sid=1546

2.3 Assignment #2: Detect 3: MISC Tiny Fragment

Packet 1:

```
Windump output:
19:02:07.776507 IP (tos 0x0, ttl 235, len 40) 192.9.100.88 > 32.245.235.65: tcp (frag 0:20@60824+)bad
cksum 4b6e (->6184)!
0x0000   4500 0028 0000 3db3 eb06 4b6e c009 6458        E..(..=...Kn..dX
0x0010   20f5 eb41 0924 0050 0152 f5c0 0152 f5c0        ...A.$.P.R...R..
0x0020   7204 0000 4f98 0000 0000 0000 0000             r...O.........

Snort output:
[**] MISC Tiny Fragments [**]
10/18-19:02:07.776507 192.9.100.88 -> 32.245.235.65
TCP TTL:235 TOS:0x0 ID:0 IpLen:20 DgmLen:40 MF
Frag Offset: 0x1DB3   Frag Size: 0xFFFFE261
=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
```

Packet 2:

```
Windump output:
01:51:58.976507 IP (tos 0x0, ttl 235, len 40) 192.9.100.88 > 32.245.67.198: tcp (frag 0:20@60824+)bad
cksum f5e6 (->900)!
0x0000   4500 0028 0000 3db3 eb06 f5e6 c009 6458        E..(..=.......dX
0x0010   20f5 43c6 1384 0050 02ca 338c 02ca 338c        ..C....P..3...3.
0x0020   0404 0000 df2a 0000 0000 0000 0000             .....*........

Snort output:
[**] MISC Tiny Fragments [**]
10/19-01:51:58.976507 192.9.100.88 -> 32.245.67.198
TCP TTL:235 TOS:0x0 ID:0 IpLen:20 DgmLen:40 MF
Frag Offset: 0x1DB3   Frag Size: 0xFFFFE261
=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
```

Packet 3:

```
Windump output:
15:27:48.046507 IP (tos 0x0, ttl 235, len 40) 192.9.100.88 > 32.245.218.210: tcp (frag 0:20@60824+)bad
cksum 5cdb (->71f3)!
0x0000   4500 0028 0000 3db3 eb06 5cdb c009 6458        E..(..=...\...dX
0x0010   20f5 dad2 07c4 0050 0051 8bfa 0051 8bfa        .......P.Q...Q..
0x0020   0504 0000 a4f4 0000 0000 0000 0000             ..............

Snort output:
[**] MISC Tiny Fragments [**]
10/19-15:27:48.046507 192.9.100.88 -> 32.245.218.210
TCP TTL:235 TOS:0x0 ID:0 IpLen:20 DgmLen:40 MF
Frag Offset: 0x1DB3   Frag Size: 0xFFFFE261
=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
```

Packet 4:

```
Windump output:
19:55:49.936507 IP (tos 0x0, ttl 235, len 40) 192.9.100.88 > 32.245.17.123: tcp (frag 0:20@60824+)bad
cksum 2832 (->3b4b)!
0x0000   4500 0028 0000 3db3 eb06 2832 c009 6458        E..(..=...(2..dX
0x0010   20f5 117b 057c 0050 0146 ef82 0146 ef82        ...{.|.P.F...F..
0x0020   0504 0000 a998 0000 0000 0000 0000             ..............

Snort output:
[**] MISC Tiny Fragments [**]
10/19-19:55:49.936507 192.9.100.88 -> 32.245.17.123
```

TCP TTL:235 TOS:0x0 ID:0 IpLen:20 DgmLen:40 MF
Frag Offset: 0x1DB3 Frag Size: 0xFFFFE261
=+

Packet 5:

Windump output:
23:29:37.106507 IP (tos 0x0, ttl 235, len 40) 192.9.100.88 > 32.245.73.27: tcp (frag 0:20@60824+)bad cksum ef93 (->3ab)!
0x0000 4500 0028 0000 3db3 eb06 ef93 c009 6458 E..(..=.......dX
0x0010 20f5 491b 0a97 0050 020a ac4c 020a ac4c ..I....P...L...L
0x0020 **7004** 0000 85c3 0000 0000 0000 0000 p.............

Snort output:
[**] MISC Tiny Fragments [**]
10/19-23:29:37.106507 192.9.100.88 -> 32.245.73.27
TCP TTL:235 TOS:0x0 ID:0 IpLen:20 DgmLen:40 MF
Frag Offset: 0x1DB3 Frag Size: 0xFFFFE261
=+

Packet 6:

Windump output:
21:44:21.136507 IP (tos 0x0, ttl 235, len 40) 192.9.100.88 > 32.245.76.243: tcp (frag 0:20@60824+)bad cksum ecb9 (->ffd2)!
0x0000 4500 0028 0000 3db3 eb06 ecb9 c009 6458 E..(..=.......dX
0x0010 20f5 4cf3 11d3 0050 004b 2774 004b 2774 ..L....P.K't.K't
0x0020 2804 0000 d0dc 0000 0000 0000 0000 (.............

Snort output:
[**] MISC Tiny Fragments [**]
10/20-21:44:21.136507 192.9.100.88 -> 32.245.76.243
TCP TTL:235 TOS:0x0 ID:0 IpLen:20 DgmLen:40 MF
Frag Offset: 0x1DB3 Frag Size: 0xFFFFE261
=+

Packet 7:

Windump output:
17:53:36.846507 IP (tos 0x0, ttl 235, len 40) 192.9.100.88 > 32.245.67.70: tcp (frag 0:20@60824+)bad cksum f568 (->980)!
0x0000 4500 0028 0000 3db3 eb06 f568 c009 6458 E..(..=....h..dX
0x0010 20f5 4346 0829 0050 014e 0358 014e 0358 ..CF.).P.N.X.N.X
0x0020 **5404** 0000 fd67 0000 0000 0000 0000 T....g........

Snort output:
[**] MISC Tiny Fragments [**]
10/21-17:53:36.846507 192.9.100.88 -> 32.245.67.70
TCP TTL:235 TOS:0x0 ID:0 IpLen:20 DgmLen:40 MF
Frag Offset: 0x1DB3 Frag Size: 0xFFFFE261
=+

Packet 8:

Windump output:
00:50:51.116507 IP (tos 0x0, ttl 235, len 40) 192.9.100.88 > 32.245.153.67: tcp (frag 0:20@60824+)bad cksum 9d6c (->b382)!
0x0000 4500 0028 0000 3db3 eb06 9d6c c009 6458 E..(..=....l..dX
0x0010 20f5 9943 082e 0050 02cc 0388 02cc 0388 ...C...P........
0x0020 **7004** 0000 860a 0000 0000 0000 0000 p.............

Snort output:
[**] MISC Tiny Fragments [**]

```
10/22-00:50:51.116507 192.9.100.88 -> 32.245.153.67
TCP TTL:235 TOS:0x0 ID:0 IpLen:20 DgmLen:40 MF
Frag Offset: 0x1DB3   Frag Size: 0xFFFFE261
=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
```

1. **Source of Trace**

   The source of these trace are from the logs provided by GIAC at
   www.incidents.org/logs/Raw/2002.9.22
   www.incidents.org/logs/Raw/2002.9.21
   www.incidents.org/logs/Raw/2002.9.20
   www.incidents.org/logs/Raw/2002.9.19

2. **Detect Was Generated By:**

   I used Demarc Puresecure with MySQL http://www.demarc.com to get an overall picture of the events from various logs provided by GIAC. Then I ran snort command against the raw files downloaded from http://www.incident.org/logs/Raw to upload these events into MySQL database. I disabled preprocessor stream4 and preprocessor stream4_reassemble to get better result as I did in Detect 1. The command I ran is similar to one shown below:

   snort –p –l c:\puresecure\sensor\logs –r c:\puresecure\sensor\logs_raw\2002.9.22 –c c:\puresecure\sensor\conf\snort4.conf

   Once I found an interesting events on PureSecure console, then I ran windump to capture the event from the raw file as shown below:

   C:\PureSecure\raw>windump -vvv -Xx -r 2002.9.22 "src 192.9.100.88"

   The alert generated by snort also captured from the snort logs, and each corresponding alerts detected are shown using windump and snort outputs respectively.

   The above events were detected from raw files 2002.9.22, 2002.9.21, 2002.9.20 and 2002.9.19

   The Snort rule that triggered these alerts is shown below:

   alert ip $EXTERNAL_NET any -> $HOME_NET any (msg:"MISC Tiny Fragments";fragbits:M;dsize:< 25;classtype:bad-unknown;sid:522;rev:1;)

3. **Probability the Source Address Was Spoofed**

   Very unlikely that source address was spoofed. TCP connection could have been established that showed TCP three-way-handshake was completed when these packets were sent but not captured by IDS rules. Another possibility is that this is

a clever scan that sent fragmented TCP packet with Reset flag set to confuse firewall that does not support fragment reassembly, and then waiting for respond from target host or icmp host unreachable respond from router.
Whois query also shows that source address is belongs to Sun Microsystems Corp.

```
Final results obtained from whois.arin.net.
Results:

OrgName: Sun Microsystems, Inc
OrgID: SUN
Address: 901 San Antonio Road
City: Palo Alto
StateProv: CA
PostalCode: 94303-4900
Country: US

NetRange: 192.9.10.0 - 192.9.199.255
CIDR: 192.9.10.0/23, 192.9.12.0/22, 192.9.16.0/20, 192.9.32.0/19, 192.9.64.0/18, 192.9.128.0/18,
192.9.192.0/21
NetName: SUN3
NetHandle: NET-192-9-10-0-1
Parent: NET-192-0-0-0-0
NetType: Direct Assignment
NameServer: NS.SUN.COM
NameServer: NS-BRM.SUN.COM
NameServer: NS.USEC.SUN.COM
NameServer: NS-OS.SUN.COM
Comment:
RegDate: 1983-10-17
Updated: 2002-01-16

TechHandle: IS189-ARIN
TechName: Sun Microsystems, Inc.
TechPhone: +1-303-272-7000
TechEmail: Netmaster@sun.com

# ARIN WHOIS database, last updated 2003-04-22 20:10
```

4. Description of Attack

This attack is using combination of unique fragmentation on TCP packet characteristics and TCP flag Reset being set. The nature of the attack is quite similar to inverse mapping techniques that can compile a list of networks or hosts that are unreachable and then use the converse of that map to determine where things probably are. [7]

The target is being probed on port 80, which is the most common port in use. The almost identical characteristics of these fragments were sent to daily to different host on the same first two octet of the IP address. See below:

192.9.100.88 > **32.245.**235.65
192.9.100.88 > **32.245.**67.198
192.9.100.88 > **32.245.**218.210

192.9.100.88 > **32.245.**17.123
192.9.100.88 > **32.245.**73.27
192.9.100.88 > **32.245.**76.243
192.9.100.88 > **32.245.**67.70
192.9.100.88 > **32.245.**153.67

Each of the packet has RST flag set, TTL of 235, fragment ID 0, 20 bytes size, offset of 60824 and More Fragment (MF) fragment flag set.

5. **Attack Mechanism**

Let us discuss the nature of these packet in detail. First, let us examine the fragmentation flag shown in the windump output below which is identical on each fragment occurred daily:

frag 0:20@60824+

The "frag 0" shown above specify the value of the identification field in the IP header
"20" shows the size of the data which is 20 bytes
"60824" is the offset of the data in the fragment.
"+" sign shows that More Fragment (MF) flag is set.

The non-zero offset number followed by a "+" shows us that this packet is in the middle of fragmentation. The first packet in beginning of fragmented packet should shows "@0+" for zero offset and more packet to follow. While the last fragmented packet should shows "@60824" for the last offset number without the "+" sign, means no more packet to follow.

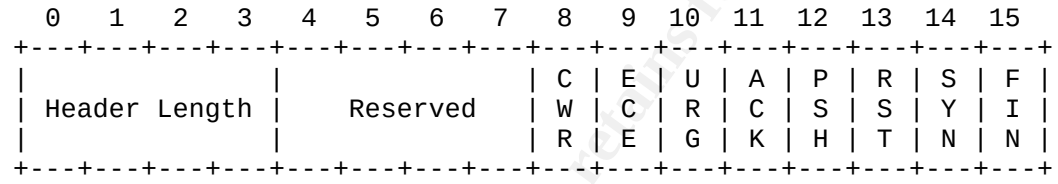
Since we know that these packets detected above are all middle fragments, however all these packet also contain TCP header information since only the first fragment can contain the embedded protocol's header information. This is weird and does not make sense. TCP is also known to avoid fragmentations since if one fragment is lost that came from TCP segment, TCP will time out and resubmit the entire diagram. Due to [6]

Since header is added in each of these fragment, let's examine the TCP flags set in each of these fragments:

Packet	Bolded payload (In HEX)	Header Length (4 bits in binary)	Reserved Bits (6 bits in binary)	TCP Flags (Urg, Ack, Psh, Rst, Syn, Fin)	Meaning
Packet1	7204	0110	001000	000100	RST flag is set. Reserved bit also set
Packet2	0404	0000	010000	000100	RST flag is set. Reserved bit also set
Packet3	0504	0000	010100	000100	RST flag is set. Reserved

					bits also set
Packet4	0504	0000	010100	000100	RST flag is set. Reserved bits also set
Packet5	7004	0111	000000	000100	RST flag is set.
Packet6	2804	0010	100000	000100	RST flag is set. Reserved bits also set
Packet7	5404	0101	010000	000100	RST flag is set. Reserved bits also set
Packet8	7004	0111	000000	000100	RST flag is set.

Many of the above packets has Reserved bit set. However, RFC 3360 stated that since these reserved bits are for future use, the use of these bits is prohibited, except two bits to the left of URG flag bit as shown below.



These two bits are only used for CWE (Congestion Windows Reduced) and ECE (Explicit Congestion Notification (ECN) Echo) as shown in figure above. [8]

All these characteristics are proves that this could be crafted packet for the purpose of probing networks or hosts, that the I have not seen before.

6. **Correlations**

I am also seeing the same source address 192.9.100.88 probing the network that I have access to. See below for the TCP payload information captured:

Packet2: 22 Sep 2002 06:32:32 192.9.100.88 -> MY.NET.208.159
TCP Payload in Hex: 0ED1 **0050** 0095 2F18 0095 2F18 **0504** 0000 D71C 0000

The TCP is targeted to port 80 and the above TCP flag also shows RST flag set and Reserved bits set. This is very similar to the packets we discussed in this detect.

Reto Baumann [4] detected similar packet from the GIAC Raw logs. Andrew Rucker Jones commented that even though Fragment ID 0 is rarely used, it is sometimes used even in the middle of conversation. [5]

7. **Evidence of Active Targeting**

This is not active targeting since targets are chosen in random. This is probably slow scan attempted to do inverse mapping of networks or hosts available in the

internet.

8. **Severity**

   Severity is calculated using formula:

   Severity = (Criticality + Lethality) – (System Countermeasures + Network Countermeasures)

   With each elements worth 1 to 5 points where 1 is the least and 5 is the highest.

   Criticality: In the HEX showed that targeted port 80, which possibly targeting a web server. So, I gave 4 points.

   Lethality: This packet could be lethal if target is vulnerable to malformed fragment packet. So, I gave 4 point.

   System Countermeasures: Server might have been patched and no longer vulnerable to malformed fragment packets since these packets keep coming almost daily, so I gave 3 points.

   Network Countermeasures: There is probably existed some network countermeasures, so I gave 3 point.

   Severity = (4+4) – (3+3) = 2

9. **Defensive Recommendation**

   Install firewall that support fragment reassembly at defense perimeter. Every fragmented packet will first reassemble and analyze to detect whether it is normal fragmented packet or malformed packet before allow to pass through. Normal fragmented packet will then allowed through while malformed fragmented packet will be dropped.

10. **Multiple Choice Test Question**

    Q: From a TCP header below, what flag(s) is(are) set?

    0ED1 0050 0095 2F18 0095 2F18 0504 0000 D71C 0000

    A) SYN and RST flags are set
    B) SYN flag is set
    C) RST and URG flags are set
    D) RST is set and Reserve bit is also set

Answer is D.
Bytes 0x0504 above is translated to binary value of 0000 000101 000100

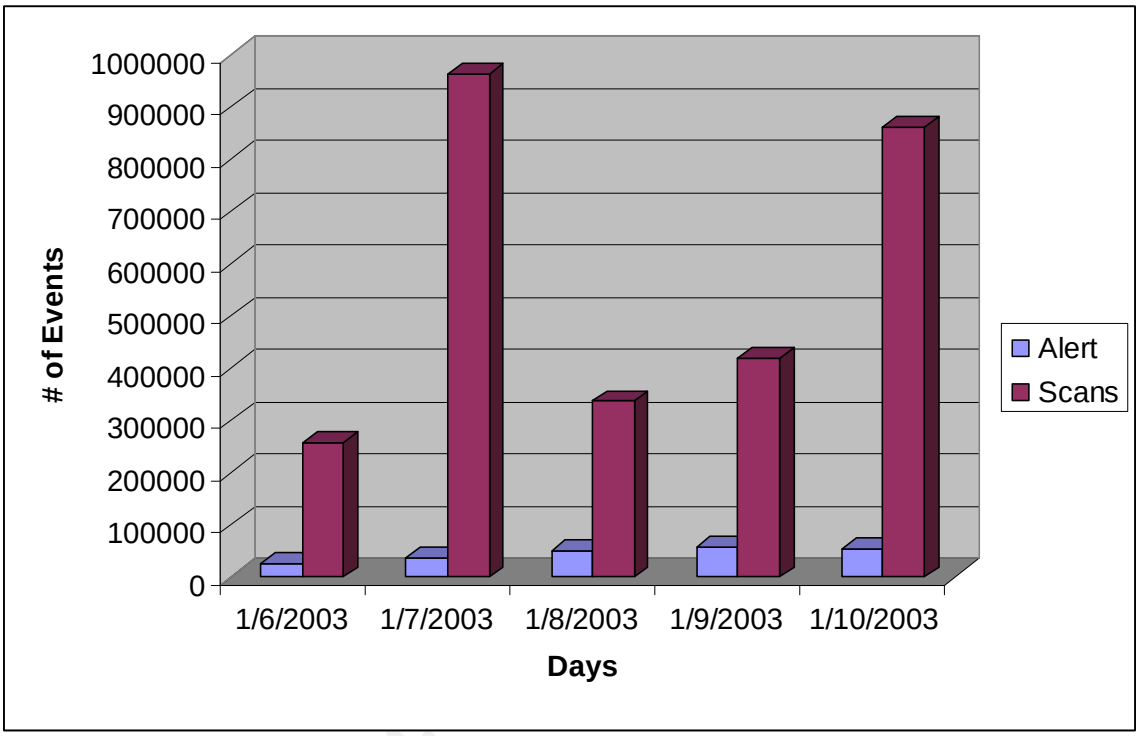
Header Length	Reserve Bit	URG	ACK	PSH	RST	SYN	FIN
0000	000101	0	0	0	1	0	0

References:

1. Whois query: http://www.geektools.com/cgi-bin/proxy.cgi
2. Ardoin, Cy; Oct 16 1996; http://www.netsys.com/firewalls/firewalls-9610/0570.html
3. Metati, Prabhaker; Spoofing and Fragmentation; http://www.cs.wright.edu/~pmateti/InternetSecurity/Lectures/IPexploits/
4. Baumann, Reto; LOGS:GIAC GCIA Version 3.3 Practical Detect(s); 2003 Mar 11; http://cert.uni-stuttgart.de/archive/intrusions/2003/03/msg00136.html
5. Jones, Andrew Rucker; Re: LOGS: GIAC GCIA Version 3.3 Practical Detect(s); 2003 Mar 11; http://cert.uni-stuttgart.de/archive/intrusions/2003/03/msg00156.html
6. Stevens, Richard W; TCP/IP Illustrated Volume 1, The Protocols; Nov 2001; pages 148-153
7. Northcutt, Stephen; Novak, Judy; Network Intrusion Detection, An Analyst's Handbook; Second Edition; Sept 2000
8. RFC 3360; Inappropriate TCP Resets Considered Harmful; http://www.faqs.org/rfcs/rfc3360.html
9.

Assignment #3: Analyze This.

3.1 Overview of analysis



Daily graph of number of events generated by Alerts and Scans:

Year 2003	6-Jan	7-Jan	8-Jan	9-Jan	10-Jan
Alert	26416	37731	50608	57620	55258
Scans	258006	964355	336962	417996	860281

Looking at the above bar graph of daily events in the University's security log analyzed, showed huge differences of scans activities and alerts detected in the environment. A big spike in scans occurred on Tuesday and Friday, while alerts graphs are in incline trend.

Even with some security measures already in place, Nimda break loose in the campus network. A lot of internal machines were infected, and/or in process of getting infected. Besides Nimda, many internal machines are also compromised by Trojan, and backdoor controlled by outsiders via IRC XDCC.

Scans activities are very high, either due to Nimda probing activities, or scanning tools such as Queso, nmap and others. Two internal hosts i.e. MY.NET.84.151 and MY.NET.88.193 have been determined to be infected by Code Red worm and caused a massive traffic in internal network. Action need to be taken as soon as possible to take these machine off line and clean them up from worm.

3.2 **List of files analyzed:**

Here are the list of files I choose to analyze from http://www.incidents.org/logs

Alert Files	Size (Bytes)
alert.030106.gz	700,538
alert.030107.gz	1,519,896
alert.030108.gz	1,030,895
alert.030109.gz	1,268,750
alert.030110.gz	1,705,287

OOS Files	Size (Bytes)
OOS_Report_2003_01_06_18360.txt	220,163
OOS_Report_2003_01_07_31845.txt	332,803
OOS_Report_2003_01_08_8856.txt	291,843
OOS_Report_2003_01_09_12713.txt	209,923
OOS_Report_2003_01_10_4480.txt	230,403

Scan Files	Size (Bytes)
scans.030106.gz	2,399,652
scans.030107.gz	7,823,839
scans.030108.gz	2,712,394
scans.030109.gz	3,441,161
scans.030110.gz	6,850,256

227633 snort events analyzed in Alert files listed above.
2837600 scans events analyzed in Scans files listed above.
4149 events analyzed in OOS files listed above.

3.3 **A list of detects**

Below is a list of detects prioritized by severity or number of occurrences. Brief description of these events, analysis identifying relationships between sources and targets machines, correlation with other GIAC papers and recommendations are also included. To fulfill the requirement for this paper, I also included a Link Graph and five external source addresses and registration information about these addresses.

There are 227633 alerts detected from Snort log provided by GIAC. Below is the list of Alerts that is more than 1 detect.

Rank	Signature	# of Alerts	# of Sources	# of Dests
#1	High port 65535 tcp - possible Red Worm - traffic	95437	294	276
#2	SMB Name Wildcard	39725	1109	918
#3	Spp_http_decode: IIS Unicode attack detected	31952	420	634

#4	Watchlist 000220 IL-ISDNNET-990517	26083	79	120
#5	TFTP - External UDP connection to internal tftp server	17283	9	5
#6	High port 65535 udp - possible Red Worm - traffic	4391	91	108
#7	Spp_http_decode: CGI Null Byte attack detected	2197	55	80
#8	Watchlist 000222 NET-NCFC	1816	26	26
#9	Possible trojan server activity	1556	18	16
#10	Port 55850 tcp - Possible myserver activity - ref. 010313-1	1335	49	51
#11	Queso fingerprint	1253	86	36
#12	IDS552/web-iis_IIS ISAPI Overflow ida nosize [arachNIDS]	1185	1036	559
#13	Null scan!	601	32	27
#14	EXPLOIT x86 NOOP	558	46	58
#15	Incomplete Packet Fragments Discarded	431	33	19
#16	TFTP - Internal TCP connection to external tftp server	424	2	2
#17	SUNRPC highport access!	368	38	42
#18	IRC evil – running XDCC	197	8	21
#19	SMB C access	152	95	15
#20	TCP SRC and DST outside network	143	14	18
#21	NMAP TCP ping!	132	54	44
#22	EXPLOIT x86 setuid 0	84	63	39
#23	ICMP SRC and DST outside network	74	6	7
#24	TFTP - Internal UDP connection to external tftp server	56	14	11
#25	EXPLOIT x86 setgid 0	42	38	30
#26	Port 55850 udp - Possible myserver activity - ref. 010313-1	15	6	3
#27	Attempted Sun RPC high port access	14	5	7
#28	RFB - Possible WinVNC - 010708-1	13	9	8
#29	Tiny Fragments - Possible Hostile Activity	11	5	4
#30	EXPLOIT x86 stealth noop	11	4	5
#31	TFTP - External TCP connection to internal tftp server	7	1	1
#32	EXPLOIT NTPDX buffer overflow	6	6	6
#33	NIMDA - Attempt to execute cmd from campus host	4	4	2

3.4 Below are descriptions of the Alerts events

Alert#1: High port 65535 tcp - possible Red Worm – traffic
Alert#6: High port 65535 udp - possible Red Worm – traffic
Alert#3: spp_http_decode: IIS Unicode attack detected
Alert#12: IDS552/web-iis_IIS ISAPI Overflow ida nosize [arachNIDS]

All the above alerts showed that there are a lot of Code Red worm activities in the environment. Code Red is self=propagating malicious code that exploits IIS-enabled machines vulnerable to exploit exist in CERT advisory CA-2001-13 Buffer

Overflow In IIS Indexing Service DLL. It may also impact machines that is not directly vulnerable to this exploit. A sample of Code Red footprint is shown below:

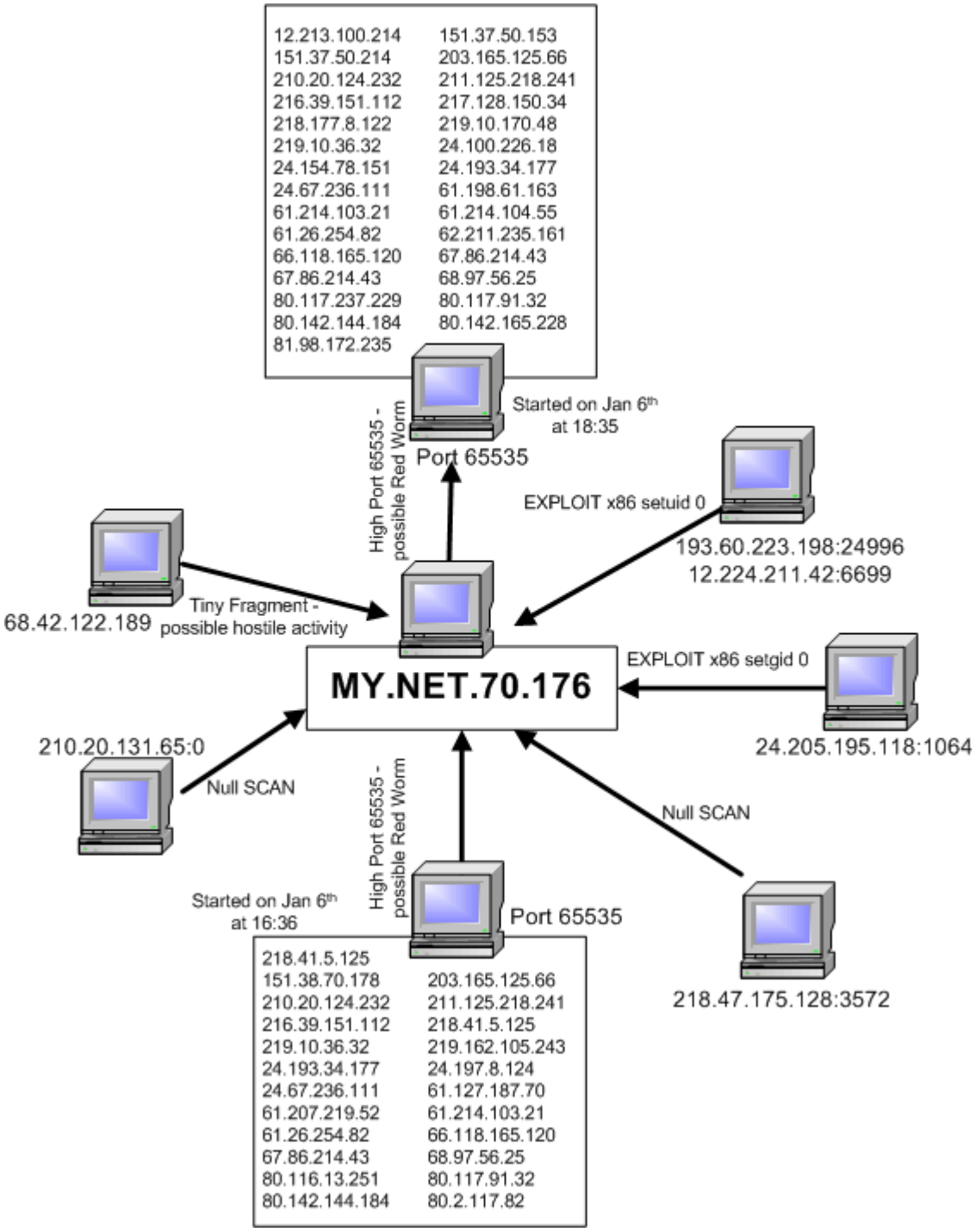
```
/default.ida?NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN
NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN
NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN
NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN
NNNNNNNNNNNNNNN%u9090%u6858%ucbd3%u7801%u9090%u6858%ucbd3%u780
1%u9090%u6858%ucbd3%u7801%u9090%u9090%u8190%u00c3%u0003%u8b00%u5
31b%u53ff%u0078%u0000%u00=a
```

[48]

The below Link Graph showed internal machine MY.NET.70.176 was bombarded with Code Red scans that started at 4:36pm on January 6th. A couple of hours later at 6:35pm, MY.NET.70.176 was infected with Code Red and started scanning other machines.

One of characteristics of Code Red infected machines as shown in Link Graph above, are really noisy in network. Thus, machines with a less alerts generated could be false positives. There is also possibility that the high port scan on port 65535 is not Code Red, but caused buy other worm scan or malicious software. Below is a list of internal machines. The top of the list are surely have been infected by Code Red.

Internal Source	# of Alerts	# of Targets
MY.NET.84.151	21336	129
MY.NET.88.193	17410	135
MY.NET.83.146	2204	85
MY.NET.70.176	623	31
MY.NET.150.213	199	14
MY.NET.91.72	89	10
MY.NET.88.226	63	2
MY.NET.6.40	22	9
MY.NET.113.4	21	8
MY.NET.140.136	16	9
MY.NET.150.83	13	2
MY.NET.198.220	5	1
MY.NET.154.30	4	1
MY.NET.132.50	4	3
MY.NET.150.215	3	1
MY.NET.85.91	2	1
MY.NET.82.114	1	1
MY.NET.182.109	1	1
MY.NET.151.128	1	1



Link Graph: Code Red infected machine

The top 5 external Code Red sources:

IP address	DNS name	# of Alerts
172.186.226.148	?? last hit rt-frrtq08.proxy.aol.com (195.93.89.173)	5102

OrgName: America Online
OrgID: AOL

NetRange: 172.128.0.0 - 172.191.255.255
CIDR: 172.128.0.0/10
NetName: AOL-172BLK
NetHandle: NET-172-128-0-0-1
Parent: NET-172-0-0-0-0
NetType: Direct Allocation
NameServer: DAHA-01.NS.AOL.COM
NameServer: DAHA-02.NS.AOL.COM
Comment: ADDRESSES WITHIN THIS BLOCK ARE NON-PORTABLE
RegDate: 2000-03-24
Updated: 2002-08-09

TechHandle: AOL-NOC-ARIN
TechName: America Online, Inc.
TechPhone: +1-703-265-4670
TechEmail: domains@aol.net

OrgAbuseHandle: AOL382-ARIN
OrgAbuseName: Abuse
OrgAbusePhone: +1-703-265-4670
OrgAbuseEmail: abuse@aol.net

OrgNOCHandle: AOL236-ARIN
OrgNOCName: NOC
OrgNOCPhone: +1-703-265-4670
OrgNOCEmail: noc@aol.net

OrgTechHandle: AOL-NOC-ARIN
OrgTechName: America Online, Inc.
OrgTechPhone: +1-703-265-4670
OrgTechEmail: domains@aol.net

67.69.224.186	Toronto-HSE-ppp3845963.sympatico.ca	2530

Bell Canada BELLNEXXIA-11 (NET-67-68-0-0-1)
67.68.0.0 - 67.70.255.255
Bell Sympatico HSE1129-CA (NET-67-69-192-0-1)
67.69.192.0 - 67.69.255.255

OrgName: Bell Canada
OrgID: LINX

NetRange: 67.68.0.0 - 67.70.255.255
CIDR: 67.68.0.0/15, 67.70.0.0/16
NetName: BELLNEXXIA-11
NetHandle: NET-67-68-0-0-1
Parent: NET-67-0-0-0-0
NetType: Direct Allocation
NameServer: NS3.BELLGLOBAL.COM
NameServer: NS4.BELLGLOBAL.COM
Comment: ADDRESSES WITHIN THIS BLOCK ARE NON-PORTABLE
RegDate: 2002-04-18
Updated: 2003-01-16

TechHandle: MK1209-ARIN
TechName: Khalid, Mohammad
TechPhone: +1-800-450-7771
TechEmail: noc@in.bell.ca

OrgTechHandle: SYSAD1-ARIN
OrgTechName: Sys Admin
OrgTechPhone: +1-613-785-0886
OrgTechEmail: ip_prov@bellglobal.com

80.200.137.128	??	2462

inetnum: 80.200.0.0 - 80.200.255.255
netname: BE-SKYNET-20011108
descr: ADSL Customers
descr: Skynet Belgium
country: BE
admin-c: JFS1-RIPE
tech-c: PDH16-RIPE
status: ASSIGNED PA
mnt-by: SKYNETBE-MNT
changed: ripe@skynet.be 20011212
source: RIPE

route: 80.200.0.0/15
descr: SKYNETBE-CUSTOMERS
origin: AS5432
notify: noc@skynet.be
mnt-by: SKYNETBE-MNT
changed: noc@skynet.be 20011116
source: RIPE

person: Jean-Francois Stenuit
address: Belgacom Skynet NV/SA
address: Rue Carli 2
address: B-1140 Bruxelles
address: Belgium
phone: +32 2 706-1311
fax-no: +32 2 706-1150
e-mail: jfs@skynet.be
nic-hdl: JFS1-RIPE
remarks: ----------
remarks: Network problems to: noc@skynet.be
remarks: Peering requests to: peering@skynet.be
remarks: Abuse notifications to: abuse@skynet.be
remarks: ----------
mnt-by: SKYNETBE-MNT
changed: jfs@skynet.be 19970707
changed: ripe@skynet.be 20021125
source: RIPE

person: Pieterjan d'Hertog
address: Belgacom Skynet sa/nv
address: 2 Rue Carli
address: B-1140 Brussels
address: Belgium
phone: +32 2 706 13 11
fax-no: +32 2 706 13 12
e-mail: piet@skynet.be
nic-hdl: PDH16-RIPE
remarks: ----------
remarks: Network problems to: noc@skynet.be
remarks: Peering requests to: peering@skynet.be
remarks: Abuse notifications to: abuse@skynet.be
remarks: ----------
mnt-by: SKYNETBE-MNT
changed: jfs@skynet.be 19990415
changed: piet@skynet.be 19991210
changed: piet@skynet.be 20000302
changed: piet@skynet.be 20020329

source: RIPE

193.252.60.115	??	2010

inetnum: 193.252.60.0 - 193.252.60.255
netname: IP2000-ADSL-BAS
descr: France Telecom IP2000 ADSL BAS
country: FR
admin-c: WITR1-RIPE
tech-c: WITR1-RIPE
status: ASSIGNED PA
remarks: for hacking, spamming or security problems send mail to
remarks: postmaster@wanadoo.fr AND abuse@wanadoo.fr
remarks: for ANY problem send mail to gestionip.ft@francetelecom.com
notify: gestionip.ft@francetelecom.com
mnt-by: FT-BRX
changed: gestionip.ft@francetelecom.fr 20000412
changed: gestionip.ft@francetelecom.fr 20001024
changed: gestionip.ft@francetelecom.com 20010517
source: RIPE

route: 193.252.0.0/18
descr: France Telecom
descr: FTI
origin: AS3215
mnt-by: FT-BRX
changed: gestionip.ft@francetelecom.fr 20001018
source: RIPE

role: Wanadoo Interactive Technical Role
address: WANADOO INTERACTIVE
address: 48 rue Camille Desmoulins
address: 92791 ISSY LES MOULINEAUX CEDEX 9
address: FR
phone: +33 1 58 88 50 00
e-mail: abuse@wanadoo.fr
e-mail: postmaster@wanadoo.fr
admin-c: FTI-RIPE
tech-c: TEFS1-RIPE
nic-hdl: WITR1-RIPE
notify: gestionip.ft@francetelecom.com
mnt-by: FT-BRX
changed: gestionip.ft@francetelecom.com 20010504
changed: gestionip.ft@francetelecom.com 20010912
changed: gestionip.ft@francetelecom.com 20011204
source: RIPE

80.14.209.119	??	1722

inetnum: 80.14.209.0 - 80.14.209.255
netname: IP2000-ADSL-BAS
descr: BSREI105 Reims Bloc2
country: FR
admin-c: WITR1-RIPE
tech-c: WITR1-RIPE
status: ASSIGNED PA
remarks: for hacking, spamming or security problems send mail to
remarks: postmaster@wanadoo.fr AND abuse@wanadoo.fr
remarks: for ANY problem send mail to gestionip.ft@francetelecom.com
mnt-by: FT-BRX
changed: gestionip.ft@francetelecom.com 20020220
changed: gestionip.ft@francetelecom.com 20020723
source: RIPE

route: 80.14.0.0/16
descr: France Telecom

```
descr: Wanadoo Interactive
remarks: ----------------------------------------
remarks: For Hacking, Spamming or Security problems
remarks: send mail to abuse@francetelecom.net
remarks: ----------------------------------------
origin: AS3215
mnt-by: RAIN-TRANSPAC
mnt-by: FT-BRX
changed: karim@rain.fr 20011221
source: RIPE

role: Wanadoo Interactive Technical Role
address: WANADOO INTERACTIVE
address: 48 rue Camille Desmoulins
address: 92791 ISSY LES MOULINEAUX CEDEX 9
address: FR
phone: +33 1 58 88 50 00
e-mail: abuse@wanadoo.fr
e-mail: postmaster@wanadoo.fr
admin-c: FTI-RIPE
tech-c: TEFS1-RIPE
nic-hdl: WITR1-RIPE
notify: gestionip.ft@francetelecom.com
mnt-by: FT-BRX
changed: gestionip.ft@francetelecom.com 20010504
changed: gestionip.ft@francetelecom.com 20010912
changed: gestionip.ft@francetelecom.com 20011204
source: RIPE
```

Three of the above external Code Red sources are XDSL connected machines, one via dialup (PPP) and one undertermined AOL client (assumed to be dialup). All the above ISPs need to be notified about their clients' Code Red infected machines.

Correlation: Joe Ellis [10] noted this event as known Code Red alerts. He also agreed the possibilities of false positive on low generating alert sources.

Recommendation: Code Red infected machines need to be taken off network immediately. Then cleaned from the worm and patched to ensure no future infection. To stop any attempts to exploit Unicode vulnerabilities from the Internet, Unicode rules need to be added to egress/ingress filter at outer firewall, to drop packet matching this rule.

Alert#33: NIMDA - Attempt to execute cmd from campus host

Nimda worm was found on September 18th, 2001 and it spread quickly around the world. Nimda is a complex virus with a mass mailing worm component which spreads itself in attachments named README.EXE if affected. [25]

It is propagating with unprecedented speed across the Internet. The worm appears to have at least four distinct propagation mechanisms, and infect hosts running any version of Windows. The network activity caused by the worm has resulted in an effective denial of service attack at many sites.

The worm scans the Internet for IIS servers and attempts to exploit a number of IIS vulnerabilities to gain control of a victim host including exploitation of the "IIS Directory Transversal Vulnerability" and utilization of backdoors left behind by previous Code Red II worm. Once in control of a victim IIS server, the worm uses TFTP to transfer its code from the attacking machine to the victim.
The worm also takes advantage of a known vulnerability called "Automatic Execution of Embedded MIME Types" discussed in CERT advisory CA-2001-06. Exploiting this vulnerability, Nimda harvests email addresses from the Windows address book and user's inboxes and sends itself to all addresses as an attachment named "readme.exe".

If the worm successfully infects a web server, it uses the HTTP service to propagate itself to clients who browse the web server's pages. Upon infecting a victim server, the worm creates a copy of itself named "readme.eml" and traverses the directory tree, including network shares, searching for web-related files such as those with .html, .htm or .asp extensions, and append a piece of JavaScript to the file. The JavaScript forces a download of readme.eml to any client that views the file via a browser.

The worm is also network aware and propagates via open file shares. It will copy itself to all directories, including those found in network shares, for which user has write permission. This worm copies are named "readme.eml". Any other host that accesses the share and executes or previews one of these files can become infected. [26]

Alert#2) SMB Name Wildcard

This is NETBIOS SMB Service scan on port 137. There are two possibilities. One is possibilities of scriptkiddies are more aware of NBTSTAT tool capabilities in gathering machine information and secondly, the spread of an internet worm known as network.vbs. Use of standard Netbios "nbtstat" frames, will bring out a node status response from Netbios and SAMBA clients. This response contains a listing of any Netbios names known to that node. [6]

Correlation: Brian Credeur noted this event in his GCIA paper as reconnaissance technique. [27]

Recommendation: Outer firewall should be configured to block any NetBIOS traffic from going into internal network. That includes all TCP and UDP traffic to ports 135-139.

Alert#4) Watchlist 000220 IL-ISDNNET-990517

All 76 sources 212.179.x.x of this large number of scans were from cable modem hosts on from Israel. These addresses have been added to this Watchlist, probably

because of previous attack or stream of suspicious packets and activities, originating and/or targeting these networks. The name registration in Whois database is as below:

```
inetnum: 212.179.127.0 - 212.179.127.127
netname: ARAVA-DEVELOPMENT-COMPANY-LTD
descr: ARAVA-DEVELOPMENT-LAN
country: IL
admin-c: ES4966-RIPE
tech-c: NP469-RIPE
status: ASSIGNED PA
notify: hostmaster@isdn.net.il
mnt-by: RIPE-NCC-NONE-MNT
changed: hostmaster@isdn.net.il 20000525
source: RIPE

route: 212.179.64.0/18
descr: ISDN Net Ltd.
origin: AS8551
notify: hostmaster@bezeqint.net
mnt-by: AS8551-MNT
changed: hostmaster@bezeqint.net 20020618
source: RIPE

person: Eran Shchori
address: BEZEQ INTERNATIONAL
address: 40 Hashacham Street
address: Petach-Tikva 49170 Israel
phone: +972 3 9257710
fax-no: +972 3 9257726
e-mail: hostmaster@bezeqint.net
nic-hdl: ES4966-RIPE
changed: registrar@ns.il 20000309
source: RIPE
```

```
01/08-08:01:43.829910  Watchlist 000220 IL-ISDNNET-990517  212.179.107.226:80 -> MY.NET.177.58:1090
01/08-08:01:44.298288  Watchlist 000220 IL-ISDNNET-990517  212.179.107.226:80 -> MY.NET.177.58:1091
01/08-08:01:44.328758  Watchlist 000220 IL-ISDNNET-990517  212.179.107.226:80 -> MY.NET.177.58:1090
01/08-08:01:44.459532  Watchlist 000220 IL-ISDNNET-990517  212.179.107.226:80 -> MY.NET.177.58:1091
01/08-08:01:44.460446  Watchlist 000220 IL-ISDNNET-990517  212.179.107.226:80 -> MY.NET.177.58:1091
01/08-08:01:44.460954  Watchlist 000220 IL-ISDNNET-990517  212.179.107.226:80 -> MY.NET.177.58:1091
01/08-08:01:44.514752  Watchlist 000220 IL-ISDNNET-990517  212.179.107.226:80 -> MY.NET.177.58:1090
01/08-08:01:44.516136  Watchlist 000220 IL-ISDNNET-990517  212.179.107.226:80 -> MY.NET.177.58:1090
```

Connection to local machines on Port 1090 as shown in Snort log above showed why these are suspicious. Port 1090 is a well known port used by a Trojan called Xtreme. [14]

Correlation: Mark Menke noted this event with suspicious telnet connectivity into the internal network from Watchlist addresses. [28]

Recommendation: MY.NET.177.58 machine and other affected hosts need to be cleaned from Trojan and any backdoor installed. Usually, if backdoor already installed, the safest thing to do is to format the harddrive and fully reinstall the OS.

Alert#5: TFTP - External UDP connection to internal tftp server
Alert#16: TFTP - Internal TCP connection to external tftp server
Alert#24: TFTP - Internal UDP connection to external tftp server
Alert#31: TFTP - External TCP connection to internal tftp server

External to Internal

```
01/08-07:49:35.415308  TFTP - Internal TCP connection to external tftp server  209.126.214.14:69 -> MY.NET.70.225:3979
01/08-07:49:35.721862  TFTP - Internal TCP connection to external tftp server  209.126.214.14:69 -> MY.NET.70.225:3979
01/08-07:49:38.591639  TFTP - Internal TCP connection to external tftp server  209.126.214.14:69 -> MY.NET.70.225:3979
01/08-07:49:38.749840  TFTP - Internal TCP connection to external tftp server  209.126.214.14:69 -> MY.NET.70.225:3979
01/08-07:49:38.756097  TFTP - Internal TCP connection to external tftp server  209.126.214.14:69 -> MY.NET.70.225:3979
```

Internal to External

```
01/08-07:49:35.328148  TFTP - Internal TCP connection to external tftp server  MY.NET.70.225:3979 -> 209.126.214.14:69
01/08-07:49:35.415558  TFTP - Internal TCP connection to external tftp server  MY.NET.70.225:3979 -> 209.126.214.14:69
01/08-07:49:38.623538  TFTP - Internal TCP connection to external tftp server  MY.NET.70.225:3979 -> 209.126.214.14:69
01/08-07:49:38.668266  TFTP - Internal TCP connection to external tftp server  MY.NET.70.225:3979 -> 209.126.214.14:69
01/08-07:49:38.668383  TFTP - Internal TCP connection to external tftp server  MY.NET.70.225:3979 -> 209.126.214.14:69
```

It is very unusual and suspicious for TFTP connections to and from the Internet. TFTP (Trivial File Transfer Protocol) usually used to upgrade router configuration files that can be automated. The same protocol is also used by Nimda worm to transfer its files.
Snort log shown above showed a very active connection between MY.NET.70.225 and external IP address 209.126.214.14 which is suspicious. Without detail information, I can only conclude that MY.NET.70.225 is whether has been compromised or misconfigured.

Correlation: Joe Ellis [10] and Michael Wilkinson [29] also noted of this events in their paper. There are two possibilities that can happen from this scenario, which is misconfigured router or host already been compromised.

Recommendation: Local host MY.NET.70.225 need to be check for possibilities of misconfiguration or compromised.

Alert#7: spp_http_decode: CGI Null Byte attack detected

This is part of pre-processor that is looking for a string of "%00" in payload of http request. However, it can produce false positive for sites that use cookies encrypted data or SSLencrypted message on port 443. [11]
This attack is also known as "Poison NULL byte attack" that "%00" string appended to a URL to confuse a perl script about where the end of an input. [12] [13]

Correlation: Pedro Bueno noted in his paper about this event that false positive can occur with sites that included urlencoded binary data. [34]

Recommendation: Refine this rule to make more specific in detecting CGI Null Byte attack, and reducing false positive.

Alert#8: Watchlist 000222 NET-NCFC

This Watchlist is to monitor activities of IP addresses 159.226.x.x originating from The Computer Network Center Chinese Academy of Sciences as shown below from Whois query. Since these IP address has been added to monitored lists, there must be suspicious activities that is being investigated. Whois query on Geektools.com proved that these IP addresses belong to The Computer Network Center Chinese Academy of Sciences as suspected. There were 26 unique sources originating from this domain.

```
01/06-22:17:50.658799  Watchlist 000222 NET-NCFC  159.226.238.63:4024 -> MY.NET.162.91:21
01/06-22:17:50.938510  Watchlist 000222 NET-NCFC  159.226.238.63:4024 -> MY.NET.162.91:21
01/06-22:17:51.222952  Watchlist 000222 NET-NCFC  159.226.238.63:4024 -> MY.NET.162.91:21
01/06-22:17:51.499346  Watchlist 000222 NET-NCFC  159.226.238.63:4024 -> MY.NET.162.91:21
01/06-22:17:52.395668  Watchlist 000222 NET-NCFC  159.226.238.63:4025 -> MY.NET.162.91:4379
01/06-22:17:52.546013  Watchlist 000222 NET-NCFC  159.226.238.63:4024 -> MY.NET.162.91:21
01/06-22:17:52.996810  Watchlist 000222 NET-NCFC  159.226.238.63:4024 -> MY.NET.162.91:21
01/06-22:17:53.293090  Watchlist 000222 NET-NCFC  159.226.238.63:4025 -> MY.NET.162.91:4379
```

Eventhough these activities shown a valid FTP port of 21 connectivity, however, from other activities using non-ephemeral ports i.e. 4379 as shown above looks suspicious and need further investigation. MY.NET.162.91 need to be checked whether this host is really a valid FTP server. If it is, then this host needs to be secured, current patches installed and restrict FTP to only legitimate users.
Port 21 can also be used for a number of software including malicious software and hackers toolkits such as Black Construction, Blade Runner, Cattivik FTP Server, CC Invader, Dark FTP, Doly Trojan, Fore, Invisible FTP, Juggernaut 42. Larva, MotIv FTP, Net Administrator, Ramen, Senna Spy FTP server, The Flu, Traitor 21, WebEx and WinCrash. [14]

```
OrgName: The Computer Network Center Chinese Academy of Sciences
OrgID: CNCCAS

NetRange: 159.226.0.0 - 159.226.255.255
CIDR: 159.226.0.0/16
NetName: NCFC
NetHandle: NET-159-226-0-0-1
Parent: NET-159-0-0-0-0
NetType: Direct Assignment
NameServer: NS.CNC.AC.CN
NameServer: GINGKO.ICT.AC.CN
Comment: The information for POC handle QH3-ARIN has been reported to
be invalid. ARIN has attempted to obtain updated data, but has
been unsuccessful. To provide current contact information,
please email hostmaster@arin.net.
RegDate: 1992-06-11
Updated: 2002-10-08

TechHandle: QH3-ARIN
```

```
TechName: Xiqiong, Zhang
TechPhone: 10 82616000
TechEmail: zxq@cstnet.net.cn
```

[5]

Correlation: Bruno Marien [15] noted this event in his GCIA paper, originating from same sources of 159.226.0.0/16 owned by the Computer Network Center Chinese Academy of sciences and is known to show suspicious activities.

Recommendation: Use SSL for web connectivity that encrypted traffic for web services in MY.NET domain. Restrict upload via FTP and allow download only to outside IP addresses. Use SSH to administer any machines in the network that provide better and stronger authentication, in addition to traffic is encrypted.

Alert#9: Possible trojan server activity

```
01/10-02:16:31.373522  Possible trojan server activity  MY.NET.91.104:1214 -> 68.18.228.205:27374
01/10-15:51:55.941624  Possible trojan server activity  MY.NET.91.104:1214 -> 217.235.45.31:27374
01/10-15:51:56.982343  Possible trojan server activity  MY.NET.91.104:1214 -> 217.235.45.31:27374
01/10-15:51:56.982487  Possible trojan server activity  MY.NET.91.104:1214 -> 217.235.45.31:27374
01/10-15:51:56.982603  Possible trojan server activity  MY.NET.91.104:1214 -> 217.235.45.31:27374
```

Port 27374 is known to be used by Trojan such as Bad Blood, Ramen, Seeker, SubSeven, Subseven 2.1.4 DefCon 8, SubSevern Muie and Tftloader. A high probability that host MY.NET.91.104 has been compromised.

Correlation: Jason Lam noted in his paper about traffic on port 27374 which is usually affiliated with the Windows platform Trojan SubSeven. [16]

Recommendation: Host MY.NET.91.104 need to be taken offline and cleaned.

Alert#10: Port 55850 tcp - Possible myserver activity - ref. 010313-1
Alert#26: Port 55850 udp - Possible myserver activity - ref. 010313-1

These alerts are generated for activities from internal host using port 55850. For host MY.NET.140.9 as shown below, these activities are probably caused by Nimda worm infection.

```
01/07-20:20:25.947007  High port 65535 udp - possible Red Worm - traffic  MY.NET.140.9:65535 -> 128.114.129.62:33479
01/07-20:20:26.102877  High port 65535 udp - possible Red Worm - traffic  MY.NET.140.9:65535 -> 128.114.129.62:33481
01/07-20:20:26.180657  High port 65535 udp - possible Red Worm - traffic  MY.NET.140.9:65535 -> 128.114.129.62:33482
01/08-11:35:04.113154  Port 55850 udp - Possible myserver activity - ref. 010313-1  MY.NET.140.9:55850 -> 128.143.88.85:33441
01/08-11:35:04.113719  Port 55850 udp - Possible myserver activity - ref. 010313-1  MY.NET.140.9:55850 -> 128.143.88.85:33442
01/08-11:35:04.114316  Port 55850 udp - Possible myserver activity - ref. 010313-1  MY.NET.140.9:55850 -> 128.143.88.85:33443
```

Correlation: Jeff Zahr noted same event in his paper, but he assumed that it is likely due to false positive. [32]

Recommendation: Since this is related to Nimda worm infection, machines should be cleaned and patched.

Alert#11: Queso fingerprint

```
01/06-08:02:37.257517  Queso fingerprint  194.106.96.8:38210 -> MY.NET.70.231:80
01/06-08:03:03.759621  Queso fingerprint  194.106.96.8:38513 -> MY.NET.70.231:80
01/06-08:03:06.964248  Queso fingerprint  194.106.96.8:38544 -> MY.NET.70.231:80
01/06-08:05:04.444609  Queso fingerprint  194.106.96.8:39543 -> MY.NET.70.231:80
01/06-08:06:33.477981  Queso fingerprint  194.106.96.8:40269 -> MY.NET.70.231:80
```

Queso is a utility that query the TCP/IP stack on targeted machines for OS Fingerprinting. Queso also has the capability of sending spoof information. [3] This event indicates that a remote user has used the Queso tool to determine the OS of the server. [4] Snort log shown above shows clearly that a remote user is trying to determine the OS of a webserver. Whether this is just a scan or a malicious intent for future attack remains to be seen.

Correlation: Akiva Clark noted in his paper about Queso Fingerprinting. He stated that this is an example of older type of fingerprinting scan. [35]

Recommendation: Servers that have direct connectivity to the Internet such as Webserver located in DMZ need to be hardened with latest patches installed to reduce vulnerability that can be exploited by an attacker.

Alert#13: Null scan!

```
01/09-17:15:01.808111  Null scan!  194.109.247.13:0 -> MY.NET.82.248:0
01/09-17:15:06.640268  Probable NMAP fingerprint attempt  194.109.247.13:48156 -> MY.NET.82.248:22779
01/09-17:15:09.668410  Null scan!  194.109.247.13:0 -> MY.NET.82.248:0
01/09-17:15:15.577419  Null scan!  194.109.247.13:6257 -> MY.NET.82.248:6257
01/09-17:15:17.400185  Null scan!  194.109.247.13:0 -> MY.NET.82.248:0
```

Null scan probe indicates that a sequence number of zero has been seen in TCP packet and all control bits has also been set to zero which is abnormal. This should not be seen in a regular TCP packet. Attacker may be scanning target system by sending these specially formatted frames to find out services available or a reconnaissance in finding vulnerabilities to certain attack [8] [9]
Snort log above showed Null Scan! Probe and determined to be NMAP tool was used.

Correlation: Gustavo Monserrat noted this event as part of fingerprinting probe using nmap tool. [36]

Recommendation: Packet matching pattern described above should be block from entering or leaving MY.NET network. Security policy that cover usage of such tool need to be established and users are made aware of such policy.

Alert#14: EXPLOIT x86 NOOP

The NOOP warning occurs when series of NOP (no operation in assembly language) are found in a stream that could possibly a part of executable files for optimization and alignment reasons; or being part of an exploit code so that the offset doesn't need to be accurate. If it is originating from http port to a very high port, probably someone is downloading an executable. [7]

Correlation: Carlin Carpenter [19] mentioned this event in her paper, but provides no explanation.

Recommendation: There are many possibilities of false-positive occurring. It is difficult to make recommendation without other information such as payload to make a better analysis. [37]

Alert#30: EXPLOIT x86 stealth noop

This event is triggered by binary data in the packet matched one kind of byte sequence used as filler in buffer overflow attacks. If the attackers suspect that you have a server which is vulnerable to buffer overflow, they will attempt to exploit this vulnerability to gain access. [37] However, this binary pattern can also occur in binary data, thus resulting in false positive.

Correlation: Carlin Carpenter [19] and Hee So [24] mentioned this event in her paper, but provide no explanation.

Recommendation: Further detail analysis that includes payload information is required to determine if this is real attack or false positive.

Alert#22: EXPLOIT x86 setuid 0
Alert#25: EXPLOIT x86 setgid 0

This event occurred when shellcode to set the user identity to 0 (root) was detected. If this code is execured successfully, it is possible for the current process to inherit root privileges. However, setuid(2) requires root privileges to be executed in the first place if the currect uid is attempting to get a higher privilege level. [38] However, many false positive can occur due to binary or text files that matched the content |b017 cd80|. While setuid is for userid 0 (root), setgid attack is targeted for groupid 0 (root).

Correlation: Carlin Carpenter [19] and Joe Ellis [10] mentioned this event, but provide no explanation.

Recommendation: Further detail analysis that includes payload information is required to determine if this is a real attack or false positive.

Alert#15: Incomplete Packet Fragments Discarded

Incomplete packet fragment discarded event will triggers when snort received fragment from an 8k or larger packet do not sum more than half the packet when the last fragment is received. [39] It is also possible to be caused by bug in snort stream preprocessor. [40]

Correlation: Dan Hawrulkiw [39] noted this event in his paper that these bad packets are not unique traffic types, and that snort sensors did not received all fragments.

Recommendation: It is important to install stable version of Snort.

Alert#17: SUNRPC highport access!
Alert#27: Attempted Sun RPC high port access

```
01/08-14:17:00.810955  SUNRPC highport access!  64.236.16.137:80 -> MY.NET.55.115:32771
01/08-14:17:00.829727  SUNRPC highport access!  64.236.16.137:80 -> MY.NET.55.115:32771
01/08-14:17:00.829868  SUNRPC highport access!  64.236.16.137:80 -> MY.NET.55.115:32771
01/08-14:17:00.853861  SUNRPC highport access!  64.236.16.137:80 -> MY.NET.55.115:32771
01/08-14:17:00.854108  SUNRPC highport access!  64.236.16.137:80 -> MY.NET.55.115:32771
```

Correlation: SUNRPC connecting at high port is a concern like shown in the log above. Joe Church mentioned this event in his paper that attacker could have been compromise a target machines with vulnerabilities. In Solaris 2.x Operating Systems, rpcbind listens not only on TCP port 111, and UDP 111, but also on ports greater than 32770. This results in a large number of packet filters, which intend to block access to rpcbind/portmapper, being ineffective. Attacker instead just simply sends packet to a UDP port greater than 32770 on which RPC is listening. [46]

Alert#18: IRC evil - running XDCC

All 8 sources of these alerts are originating from internal machines and the 21 targets are all external.

```
01/07-13:47:29.057038  IRC evil - running XDCC  MY.NET.88.168:1215 -> 138.121.51.51:6667
01/07-14:47:28.987387  IRC evil - running XDCC  MY.NET.88.168:1215 -> 138.121.51.51:6667
01/07-16:07:29.030032  IRC evil - running XDCC  MY.NET.88.168:4479 -> 132.74.40.10:6667
01/07-16:47:55.699870  IRC evil - running XDCC  MY.NET.88.168:4479 -> 132.74.40.10:6667
01/07-16:48:33.318707  IRC evil - running XDCC  MY.NET.88.168:4479 -> 132.74.40.10:6667
01/07-17:17:28.941959  IRC evil - running XDCC  MY.NET.88.168:4479 -> 132.74.40.10:6667
```

01/07-18:37:28.852695 IRC evil - running XDCC MY.NET.88.168:4479 -> 132.74.40.10:6667

XDCC is a script that helps automate DCC session during IRC. DCC is a file transfer command in IRC which cannot be used from an anonymous IRC server. However, the other use of DCC is to send private messages. DCC chat is the only way at any time, according to IRC-II Help files that is not logged. XDCC is for the most part was built from toolz, a hacker tool written by hacker known as Yazoo. [1]

These traffics showed that 8 internal machines in the University have been compromised.

Correlations: Unfortunately, google search on giac.org could not find any correlation on GIAC papers. However, Chris Cramer fro Duke University explained that IRC channel is the medium using the DCC mechanism. The hacked machines are running a script which automatically logs them into the channel they receive instructions and can up/download files. Users of the IRC channel issue commands to the zombie machines in the form of:
/msg <zombie> xdcc list
/msg <zombie> xdcc send <file number>
The zombies periodically advertise their files for the channel participants. [23]

Recommendations: All internal machines such as MY.NET.88.168 and others, need fresh OS reinstall to clean any backdoor already exist in the box. If the University has a policy of restricting IRC usage, then IRC ports i.e. 6665-6669 can be blocked on border firewall.

Alert#19: SMB C access

These events showed that there were attempts to access the default administrative share C$. If allowed, the attacker can access to C: filesystem. This event is specific to a vulnerability, but may have been caused by any of several possible exploits. [2]

Correlation: Hee So noted this event in his detect. He listed several vulnerabilities in CVE database that might be attempted by attacker such as:

CAN-1999-051: A NETBIOS/SMB share password is guessable

CAN-1999-0519: A NETBIOS/SMB share passoword is the default, null or missing

CAN-1999-0520: A system-critical NETBIOS/SMB share has inappropriate access control.

CVE-2000-0979: Win95/98/ME sending a 1-byte password that matches the first character of the real password, aka the :Share Level Password" vulnerability. [24]

Recommendation: All machines in MY.NET domain must be patched against all SMB vulnerabilities. Add additional protection by installing host firewall and host intrusion detection on critical machines.

Alert#20: TCP SRC and DST outside network
Alert#23: ICMP SRC and DST outside network

```
01/06-15:00:13.145580  ICMP SRC and DST outside network  192.2.3.11 -> 192.1.3.11
01/06-16:46:11.368419  TCP SRC and DST outside network  192.2.3.11:968 -> 192.1.3.11:514
01/06-16:46:17.369465  TCP SRC and DST outside network  192.2.3.11:968 -> 192.1.3.11:514
01/06-16:46:29.372111  TCP SRC and DST outside network  192.2.3.11:968 -> 192.1.3.11:514
01/09-16:52:47.277302  TCP SRC and DST outside network  192.2.3.11:12865 -> 192.1.3.11:1612
01/09-16:54:02.288463  TCP SRC and DST outside network  192.2.3.11:12865 -> 192.1.3.11:1612
01/09-16:55:17.307077  TCP SRC and DST outside network  192.2.3.11:12865 -> 192.1.3.11:1612
```

Both alerts above were triggered by sources and destinations that are not in MY.NET network. This could be caused by misconfigured network router or any other equipment. However, looking into the source ports (0, 968, 12865) being used by 192.2.3.11 targeting 192.1.3.11 on ports (0, 514, 1612) respectively, this is probably a scan with spoofed source address.

Correlation: James Hoover noted this in his analysis with similar conclusion. "Because the source addresses are external to the home network and appear to be randomized and the destination address and ports are not randomized, this traffic appears to be generated by a script that is spoofing IP addresses." [33]

Recommendation: To block spoofing, Egress filter can be used to block non-MY.NET addresses from leaving the MY.NET network. If this is caused by routers or any equipments, these misconfigured routers or equipments will need to be fixed.

Alert#21: NMAP TCP ping!

Nmap TCP Ping was detected showing that nmap scanning tool has been used the environment to probe hosts. However, since payload information is not considered in the rule that trigger this event, it could possibly false positive.

Nmap TCP Ping works by setting the acknowledge filed to zero and sending a packet with TCP ACK flag set to determine if a network host is active. [45]

Alert#28: RFB - Possible WinVNC - 010708-1
VNC is AT&T's remote-control package that allows you to view a machines's desktop running almost any platform you can think of, from almost any other platform you can think of. The server also contains a small HTTP server that can supply a desktop-viewer Java applet to a browser, allowing you to view a desktop remotely from any Java-enabled web client.
The stock VNC uses port 5800 to serve the Java applet, and port 5900 to conduct the RFB (Remote Frame Buffer) dialogue between the client and the server.

These powerful features of VNC and free of charge, makes it popular among Windows System Administrators. However, the same tool can be used by hackers with malicious intents. [31]

Below is a some of the detect on this alert:

```
01/06-07:36:37.654342  RFB - Possible WinVNC - 010708-1  MY.NET.113.66:5900 -> 65.185.217.185:55424
01/06-07:37:10.344808  RFB - Possible WinVNC - 010708-1  MY.NET.113.64:5900 -> 65.185.217.185:55427
01/07-07:38:31.569800  RFB - Possible WinVNC - 010708-1  MY.NET.113.63:5900 -> 65.185.217.185:55530
01/07-07:38:37.421466  RFB - Possible WinVNC - 010708-1  MY.NET.113.66:5900 -> 65.185.217.185:55531
01/07-07:38:43.440080  RFB - Possible WinVNC - 010708-1  MY.NET.113.64:5900 -> 65.185.217.185:55533
```

Correlation: Michael McDonnell noted of this event in this paper that internal machines attempted to connect to external IP addresses from port 5900 which is used by VNC. He mentioned the possibilities of students or staffs who are trying to connect to their home PC by using VNC. [30]

Recommendation: Block access to VNC on firewall. However, blocking port 5900 will not be effective. Stateful inspection of VNC packet will be more effective.

Alert#29: Tiny Fragments - Possible Hostile Activity

Tiny Fragment alert is triggered when a fragment is smaller than a set threshold value. The minfrag preprocessor threshold configuration checks the size of IP fragments. The concept is that no commercial network equipments known to fragment their traffic to less than 256 bytes, so anything smaller than threshold values are very suspicious. In addition, nmap and fragroute tools fragment to either 8 or 24 bytes fragments. [17]

Correlation: Mark Embrich noted this event in his paper, stating that malicious use of fragments would include fragmenting the IP header to get it past a firewall, or a denial of service attacks like Teardrop or Jolt. [18]

Recommendation: Hosts need to be upgraded or patched from known vulnerabilities exploitable by Teardrop or Jolt attack. Use of Egress and Ingress filters in firewall to drop packet of these nature, to protect internal network and machines.

Alert#32: EXPLOIT NTPDX buffer overflow

This event indicates that a buffer overflow exploit was attempted against ntpd network time daemon. Some version of ntpd and xntpd are vulnerable to remote root access. Code used in the ntpd network time daemon uses a fixed buffer length 128 in parsing UDP packet. Sending a malformed packet greater length causes the daemon to dump core on a segmentation fault. Because ntpd almost

always runs with root privileges, a carefully constructed exploit can give remote root access. [21]

Correlation: Carlin Carpenter [19] and Matthew Fiddler [20] listed this event in their papers, but there was no discussion. This vulnerability is discussed in CVE-2001-0414.

Recommendation: NTP servers running NTPD or XNTPD need to be check for this vulnerability. Latest patches that fix this vulnerability need to be installed as soon as possible. If patches not yet available, NTP service needs to be disabled as workaround. [22]

3.5 Alerts Top Ten Analysis:

Alert: Top 10 Source and Target IP addresses

Rank	Total # Source Alerts	**Source IP**	Total # of Target Alerts	**Target IP**
1	21336	MY.NET.84.151	28969	MY.NET.84.151
2	17410	MY.NET.88.193	27643	MY.NET.88.193
3	8429	212.179.107.229	17219	192.168.0.253
4	6788	MY.NET.112.204	6786	61.236.39.3
5	5426	212.179.107.228	5970	MY.NET.90.242
6	5102	172.186.226.148	3288	MY.NET.180.39
7	4136	MY.NET.85.74	3078	172.186.226.148
8	3471	MY.NET.111.235	2227	207.200.86.66
9	3465	MY.NET.111.232	2157	207.200.86.97
10	3452	MY.NET.111.230	2134	MY.NET.177.58

The top Nimda infected sources from University's internal network are MY.NET.84.151, MY.NET.88.193, MY.NET.112.204 and MY.NET.85.74.

External IP addresses added in watchlist were also showed up in this top ten sources originating from IP addresses 212.179.107.229 and 212.179.107.228.

3.6 SCANS Analysis

Scans: Top 10 Types of Scan Activity

Rank	**Type**	**Hits**
1	UDP	2638978
2	SYN ******S*	196401
3	SYN 12******S* RESERVEDBITS	1197
4	NULL	387
5	INVALIDACK ***A*R*F	150
6	UNKNOWN 1****R** RESERVEDBITS	53

7	UNKNOWN *2*A**S* RESERVEDBITS	41
8	UNKNOWN 1**A*R** RESERVEDBITS	33
9	VECNA ****P***	28
10	NOACK **U**R*F	26
	Total	2803014

Above is a list of scans activities listed by number of occurrences.

Scans: Top 10 Source and Target IP addresses

Rank	Total # of Source Alerts	**Source IP**	Total # of Target Alerts	**Target IP**
1	943363	130.85.83.146	6790	130.85.70.198
2	721596	130.85.70.176	4206	172.171.155.23
3	157425	130.85.162.90	3517	217.36.24.213
4	154673	130.85.150.213	3477	24.58.246.210
5	113475	130.85.91.252	3427	66.91.16.206
6	95014	130.85.132.20	3192	64.231.88.19
7	60029	130.85.100.20	2928	64.231.90.179
8	57574	130.85.88.238	2482	140.117.181.222
9	42818	130.85.87.50	2299	4.62.59.34
10	39732	130.85.84.178	2268	65.94.247.34

Scans: Top 10 Target Ports

Rank	**Target Port**	**Hits**	**Port Description**
1	**6257**	1663087	Unassigned
2	**41170**	66384	Unassigned
3	**80**	48613	HTTP port
4	**445**	42634	Microsoft-DS
5	**137**	38413	NETBIOS name service
6	**27005**	26764	FLEX-LM (1-10)
7	**1214**	22036	KAZAA Peer to peer
8	**443**	20817	HTTP over SSL
9	**135**	12013	EPMAP – DCE endpoint resolution
10	**21**	10639	FTP port

Description of top three scans:

Scans#1: UDP Flood Attack

Below are some of the UDP scans analyzed from snort log provided by the GIAC:

```
Jan  6 00:16:20 130.85.83.146:6257 -> 80.117.11.127:6257 UDP
Jan  6 00:16:21 130.85.83.146:6257 -> 67.84.6.98:6257 UDP
Jan  6 00:16:20 130.85.83.146:6257 -> 80.11.94.104:6257 UDP
```

```
Jan  6 00:16:20 130.85.83.146:6257 -> 80.117.110.80:6257 UDP
Jan  6 00:16:20 130.85.83.146:6257 -> 217.225.46.19:6257 UDP
Jan  6 00:16:20 130.85.83.146:6257 -> 24.195.55.152:6257 UDP
Jan  6 00:16:20 130.85.83.146:6257 -> 217.225.241.74:6257 UDP
Jan  6 00:16:20 130.85.83.146:6257 -> 80.134.60.222:6257 UDP
Jan  6 00:16:21 130.85.83.146:6257 -> 217.127.224.150:6257 UDP
Jan  6 00:16:20 130.85.83.146:6257 -> 195.242.71.192:6257 UDP
Jan  6 00:16:20 130.85.83.146:6257 -> 24.196.221.109:6257 UDP
Jan  6 00:16:21 130.85.83.146:6257 -> 80.181.129.210:6257 UDP
Jan  6 00:16:21 130.85.83.146:6257 -> 65.24.235.22:6257 UDP
```

UDP is a connectionless protocol. Therefore no three-way-handshake as with TCP is established to start communication between client and server. If a client sends an UDP packet to a UDP port on a specific system, the system will respond with an ICMP PORT UNREACHABLE reply. Therefore, if no such answer is received, it can be deducted that the UDP port is active. Because of this behavior and many factors that can influence the communication results are usually unreliable. [41] Tools such as nmap and udp scan can be used for UDP scans.

However, based on the access to a UDP based server alone the attacker might try some basic attacks which will nevertheless allow him to refine further attacks. NFS server, SNMPXDMI server, RPCBIND/PORTMAPPER server, NIS server and SNMP server are some of the servers that can be exploited. [42]

In the case of UDP scans from the log provided, these UDP scans generated 2638978 alerts which is 94% from all scans alerts total.

Scans#2: SYN ******S* Flood Attack

Below are some of the SYN flood events detected in snort scans logs analyzed:

```
Jan  6 00:10:53 193.253.247.74:4304 -> 130.85.132.30:139 SYN ******S*
Jan  6 00:10:53 193.253.247.74:4310 -> 130.85.132.31:139 SYN ******S*
Jan  6 00:10:53 193.253.247.74:4314 -> 130.85.132.32:139 SYN ******S*
Jan  6 00:10:53 193.253.247.74:4324 -> 130.85.132.37:139 SYN ******S*
Jan  6 00:10:53 193.253.247.74:4327 -> 130.85.132.39:139 SYN ******S*
Jan  6 00:10:54 193.253.247.74:4268 -> 130.85.132.16:139 SYN ******S*
Jan  6 00:10:53 193.253.247.74:4339 -> 130.85.132.45:139 SYN ******S*
Jan  6 00:10:53 193.253.247.74:4349 -> 130.85.132.46:139 SYN ******S*
Jan  6 00:10:53 193.253.247.74:4350 -> 130.85.132.47:139 SYN ******S*
Jan  6 00:10:54 193.253.247.74:4384 -> 130.85.132.59:139 SYN ******S*
Jan  6 00:10:54 193.253.247.74:4385 -> 130.85.132.60:139 SYN ******S*
Jan  6 00:10:54 193.253.247.74:4386 -> 130.85.132.61:139 SYN ******S*
Jan  6 00:10:54 193.253.247.74:4389 -> 130.85.132.62:139 SYN ******S*
Jan  6 00:10:54 193.253.247.74:4329 -> 130.85.132.41:139 SYN ******S*
```

SYN-flood is a simple attack method on computers in a network. This technique makes server so busy that it can't provide service to the legitimate users. Unfortunately SYN-flood is both difficult to detect and avoid, because it is based on the fundamental technique for transfer of data, the TCP protocol. The attack

exploits the way TCP-connections are established between two computers on the network.
This attack utilize the time slot requires for three-way-handshake session to establish TCP connection, leaving the session incomplete by never sending the ACK flag needed. While at the same time the attacker is flooding the victim with a huge number of SYN packets. Most servers has a limited number of simultaneous connections so it is rather easy to lock a server using this technique. [43]

Scans#3: SYN 12****S* RESERVEDBITS Attack**

Below are some of the SYN 12******S* ReservedBits detected from Scans logs analyzed:

```
Jan  6 00:01:50 65.214.36.150:49339 -> 130.85.99.85:80 SYN 12****S* RESERVEDBITS
Jan  6 00:08:34 209.47.251.12:42136 -> 130.85.6.40:25 SYN 12****S* RESERVEDBITS
Jan  6 00:26:32 209.47.251.27:41924 -> 130.85.6.40:25 SYN 12****S* RESERVEDBITS
Jan  6 00:26:48 65.214.36.150:54591 -> 130.85.165.28:80 SYN 12****S* RESERVEDBITS
Jan  6 00:29:16 65.214.36.151:48158 -> 130.85.134.11:80 SYN 12****S* RESERVEDBITS
Jan  6 00:29:19 65.214.36.151:48158 -> 130.85.134.11:80 SYN 12****S* RESERVEDBITS
Jan  6 00:30:01 65.214.36.151:48158 -> 130.85.134.11:80 SYN 12****S* RESERVEDBITS
Jan  6 00:38:20 209.47.251.21:52942 -> 130.85.6.40:25 SYN 12****S* RESERVEDBITS
Jan  6 00:49:36 209.47.251.18:34569 -> 130.85.6.40:25 SYN 12****S* RESERVEDBITS
Jan  6 00:58:07 209.47.251.27:47219 -> 130.85.6.40:25 SYN 12****S* RESERVEDBITS
Jan  6 01:16:50 216.174.197.150:50537 -> 130.85.6.40:25 SYN 12****S* RESERVEDBITS
```

This scans log fits the Queso fingerprint as discussed by Jack Radigan in his GCIA practical paper. [44] Another possibility is caused by ECN traffic.

3.7 OOS (Out-Of-Specification) Analysis

OOS: Top 10 Source and Target IP addresses

Rank	Total # of Source Alerts	**Source IP**	Total # of Target Alerts	**Target IP**
1	762	194.106.96.8	1402	MY.NET.6.40
2	417	MY.NET.70.183	984	MY.NET.1.4
3	318	MY.NET.53.10	767	MY.NET.70.231
4	249	MY.NET.53.84	187	MY.NET.134.11
5	188	65.214.3.151	94	MY.NET.185.48
6	134	209.47.251.30	56	MY.NET.113.4
7	101	66.140.25.156	44	MY.NET.179.78
8	92	81.95.99.139	42	MY.NET.105.42
9	83	65.214.36.150	41	MY.NET.179.77
10	82	209.47.251.18	36	MY.NET.139.230

OOS: Top Source 194.106.96.8 (below)

```
01/06-08:02:22.400600 194.106.96.8:37981 -> MY.NET.70.231:80
01/06-08:03:03.759626 194.106.96.8:38513 -> MY.NET.70.231:80
```

```
01/06-08:03:06.740585 194.106.96.8:38542 -> MY.NET.70.231:80
01/06-08:03:06.964252 194.106.96.8:38544 -> MY.NET.70.231:80
01/06-08:04:42.601229 194.106.96.8:39398 -> MY.NET.70.231:80
01/06-08:04:45.550127 194.106.96.8:39412 -> MY.NET.70.231:80

Full Packet Header Information:

01/06-10:51:46.550239 194.106.96.8:56068 -> MY.NET.70.231:80
TCP TTL:40 TOS:0x0 ID:3679 IpLen:20 DgmLen:60 DF
12****S* Seq: 0xDC13AF9B  Ack: 0x0  Win: 0x16D0  TcpLen: 40
TCP Options (5) => MSS: 1460 SackOK TS: 693805508 0 NOP WS: 0
```

OOS: Top Target MY.NET.6.40 (below)

```
01/05-00:12:41.118651 209.47.251.20:56018 -> MY.NET.6.40:25
01/05-00:13:40.118167 209.47.251.20:32959 -> MY.NET.6.40:25
01/05-00:22:33.884514 209.47.251.30:53208 -> MY.NET.6.40:25
01/05-00:31:14.349059 209.47.251.20:56924 -> MY.NET.6.40:25
01/05-00:32:15.162532 209.47.251.14:57930 -> MY.NET.6.40:25
01/05-00:33:42.379721 209.47.251.20:41811 -> MY.NET.6.40:25

Full Packet Header Information:

01/05-00:32:15.162532 209.47.251.14:57930 -> MY.NET.6.40:25
TCP TTL:48 TOS:0x0 ID:10545 IpLen:20 DgmLen:60 DF
12****S* Seq: 0x295592D2  Ack: 0x0  Win: 0x16D0  TcpLen: 40
TCP Options (5) => MSS: 1380 SackOK TS: 460514015 0 NOP WS: 0
```

To analyze the OOS logs provided by GIAC, I looked at the top source (194.106.96.8) and top target (MY.NET.6.40) as shown above.

The same sources have also triggered Queso fingerprint alert found in Alert logs below:

```
01/06-10:17:05.165474   Queso fingerprint   194.106.96.8:48753 -> MY.NET.70.231:80
01/06-10:18:05.981252   Queso fingerprint   194.106.96.8:50160 -> MY.NET.70.231:80
01/06-10:18:17.592434   Queso fingerprint   194.106.96.8:50497 -> MY.NET.70.231:80
01/06-10:18:37.295917   Queso fingerprint   194.106.96.8:50857 -> MY.NET.70.231:80
01/06-10:18:38.225872   Queso fingerprint   194.106.96.8:50863 -> MY.NET.70.231:80
01/06-10:18:52.274253   Queso fingerprint   194.106.96.8:51187 -> MY.NET.70.231:80
01/06-10:13:55.771003   Queso fingerprint   194.106.96.8:43636 -> MY.NET.70.231:80
01/06-10:13:55.784695   Queso fingerprint   194.106.96.8:43637 -> MY.NET.70.231:80


01/06-00:26:32.561155   Queso fingerprint   209.47.251.27:41924 -> MY.NET.6.40:25
01/06-00:38:20.981326   Queso fingerprint   209.47.251.21:52942 -> MY.NET.6.40:25
01/06-00:49:36.423226   Queso fingerprint   209.47.251.18:34569 -> MY.NET.6.40:25
01/06-00:58:07.658762   Queso fingerprint   209.47.251.27:47219 -> MY.NET.6.40:25
01/06-01:17:55.748159   Queso fingerprint   209.47.251.18:52728 -> MY.NET.6.40:25
01/06-01:11:43.252864   Queso fingerprint   209.47.251.21:35592 -> MY.NET.6.40:25
01/06-02:33:19.849664   Queso fingerprint   209.47.251.21:51905 -> MY.NET.6.40:25
```

It is pretty clear that majority (if not all) of these OOS packets have been the result of Queso fingerprint in MY.NET network.

3.8 Defensive recommendations

After thoroughly analyzing and auditing the University's logs, I believed that the University has low security measures in place. Overwhelming number of intrusions that occurred are real attacks and backdoor compromises. A number of machines have been compromised by external machines, either by Nimda worms or backdoors.

Firstly, Nimda worm infections need to be addressed immediately. Especially, four of the top ten sources (MY.NET.84.151, MY.NET.88.193, MY.NET.112.204 and MY.NET.85.74) are originating from Universities' internal machines. Machines infected need to be identified, taken off-line, cleaned from the worm and patched. The Nimda traffic used up a lot of network bandwidth and leaving backdoors that can be used by other exploits.

Secondly, a lot of compromised machines via Trojan, IRC XDCC backdoor, peer to peer connections and huge amount of scanning activities in the environment showed lack of security awareness among community members in the University. This issue can be addressed by having security training, putting security policies in place and enforcement of the policies.

Thirdly, internet protections need to be improved greatly as first line of defense against attacks from Internet. Egress and Ingress filters need to be enabled on firewall to block many malicious activities such as SYN flood attack, UDP scans, backdoor compromises and many others.

3.9 A description of analysis process

Hardware used to do this analysis:
- IBM Thinkpad T20 laptop w/512MB RAM running Windows XP
- Dell Inspiron 8200 P4M 1.6GHz w/768MB DDR RAM running Windows XP/RedHat 8.0
- Sun E450 Quad CPU w/2GB RAM 400+ GB RAID running Solaris 8

My initial attempt was to use Demarc PureSecure (www.demarc.com) I had installed in my XP laptop that I used for finding detects in Assignment #2. However, it failed when I tried to run it against Alert, Scan or OOS logs. Later I found out that I can't run snort log through snort again. In my research, I found that **Brandon L. Newport** also had the same issue described in his GCIA paper pg.99 when he tried to run snort against these logs.

Later, I attempted to use SnortSnarf to parse the logs. I used configuration as suggested at http://www.tldp.org/HOWTO/Snort-Statistics-HOWTO/configuration.html#SNORTSNARF-CONFIG as reference.

First run of SnortSnarf resulted in lot of unknown IP due to "MY.NET" was used

to sanitize the logs provided by GIAC. I found out that **Tod A. Beardsley** had mentioned on the last page of his paper, page 68 that "I learn that SnortSnarf doesn't like IP addresses like MY.NET.11.8 – it accepts only numeric fields"

Later, I found a hint to address this issue on **Reuben Rubio's** GCIA practical paper to change MY.NET to something like 10.0 before running snortsnarf. I used SED command to remove MY.NET and change them to 10.0 which is not used in the logs.

What a relief, I was able to run snortsnarf and got the result for Alert logs. However, Scan logs caused out of memory on my laptop. Fortunately, I got access to a Sun E450 box running Sun Solaris 8 with to 2GB of physical RAM. Since I combined all Scan logs into one huge file, after more than a day running, memory was exhausted and SnortSnarf failed. Then I ran Scan logs one day at a time. Snortsnarf ran fine but took about a day to finish each one and had to reboot the box every time to free up memory.

Finally, I decided to use Sawmill log parser tool at www.sawmill.net for analyzing Scans and OOS logs. Thank you to the author for allowing 30 days evaluation to use without purchasing licenses. Then, I was able to run it against 180MB Scans file and finished in only 10 minutes.

References:

1- Communications of the new order Issue #3. http://216.239.51.100/search?q=cache:Cfi7iegtGPsC:www.attrition.org/~modify/texts/zines/CoTNo/cotno03.txt+IRC+evil+XDCC+6667&hl=en&ie=UTF-8
2- arachnids – IDS339 "NETBIOS-SMB-C$ACCESS" http://www.whitehats.com/cgi/arachNIDS/Show?_id=ids339&view=event
3- Rayford, Joe; GCIA Certification – Practical Assignment; Queso Fingerprint; http://www.giac.org/practical/Joe_Rayford_GCIA.doc
4- arachNIDS; IDS29 "PROBE-QUESO FINGERPRINT ATTEMPT" http://whitehats.com/info/IDS29/
5- Handel, Michael; GCIA Certification – Practical Assignment; `Watchlist 000222 NET-NCFC` http://www.giac.org/practical/Michael_Handel.doc
6- Intrusion Detection FAQ: Port 137 Scan; http://www.sans.org/resources/idfaq/port_137.php
7- Rocha, Luciano; Snort: SHELLCODE X86 NOOP http://www.der-keiler.de/Mailing-Lists/securityfocus/focus-ids/2002-04/0035.html
8- SCAN NULL: http://www.snort.org/snort-db/sid.html?sid=623
9- IDS4 "PROBE-NULL-SCAN"; http://www.whitehats.com/info/IDS4
10- Ellis, Joe; GCIA Ceritification – Practical Assignment; http://www.giac.org/practical/Joe_Ellis_GCIA.doc

11- Stewart, Joe; http://archives.neohapsis.com/archives/snort/2000-11/0244.html
12- McLain, Vitaly; http://archives.neohapsis.com/archives/snort/2000-11/0248.html
13- Phrack 55: Perl CGI problem; http://www.wiretrip.net/rfp/p/doc.asp/i3/d6.htm
14- Ports; http://www.bekkoame.ne.jp/~s_ita/port/port1-99.html
15- Marien, Bruno; GCIA Certification – Practical Assignment; http://www.giac.org/practical/Bruno_Marien_GCIA.doc
16- Lan, Jason; GCIA Certification – Practical Assignment; http://www.giac.org/practical/Jason_Lam_GCIA.doc
17- Roesch, Marty; "[Snort] Tiny Fragment"; email; http://archives.neohapsis.com/archives/snort/2000-05/0103.html
18- Embrich, Mark; GCIA Certification – Practical Assignment; http://www.giac.org/practical/Mark_Embrich_GCIA.htm
19- Carpenter, Carlin; GCIA Certification – Practical Paper; http://www.giac.org/practical/Carlin_Carpenter_GCIA.doc
20- Fiddler, Matthew; GCIA Certification – Practical Assignment; http://www.giac.org/practical/Matthew_Fiddler_GCIA.doc
21- arachnids; "NTPDX-BUFFER-OVERFLOW"; http://www.whitehats.com/info/IDS492
22- SecurityFocus; "ntpd remote buffer overflow vulnerability"; http://online.securityfocus.com/bid/2540/discussion/
23- Cramer, Chris; "[unisog] hacked university machines"; unisog@sans.org; http://staff.washington.edu/dittrich/talks/core02/unisog-xdcc.txt
24- So, Hee; GCIA Certification – Practical Assignment; http://www.giac.org/practical/Hee_So_GCIA.doc
25- F-Secure Virus Descriptions; Nimda; http://www.europe.f-secure.com/v-descs/nimda.shtml
26- Network & Academic Computing Services; "Nimda Worm Information"; September 25, 2001; http://www.nacs.uci.edu/security/nimda-info.html
27- Credeur, Brian; GCIA Certification – Practical Assignment; http://www.giac.org/practical/Brian_Credeur_GCIA.doc
28- Menke, Mark; GCIA Certification – Practical Assignment; http://www.giac.org/practical/Mark_Menke_GCIA.doc
29- Wilkinson, Michael; GCIA Certification – Practical Assignment; http://www.giac.org/practical/michael_wilkinson_gcia.doc
30- McDonnell, Michael; GCIA Certification – Practical Assignment; http://www.giac.org/practical/Michael_McDonnell_GCIA.doc
31- Knapka, Joseph; "VNC server patches for HTTP-via-RFB"; http://home.earthlink.net/~jknapka/vncpatch.html
32- Zahr, Jeff; GCIA Certification – Practical Assignment; http://www.giac.org/practical/Jeff_Zahr_GCIA.doc
33- Hoover, James; GCIA Certification – Practical Assignment; http://www.giac.org/practical/James_Hoover_GCIA.doc
34- Bueno, Pedro; GCIA Certification – Practical Assignment; http://www.giac.org/practical/Pedro_Bueno_GCIA.doc
35- Clark, Akiva; GCIA Certification – Practical Assignment; http://www.giac.org/practical/Akiva_Clark_GCIA.doc

36- Monserrat; Gustavo; GCIA Certification – Practical Assignment; http://www.giac.org/practical/Gustavo_Monserrat_GCIA.doc
37- "SHELLCODE X86 NOOP"; Snort Signature Database; http://www.snort.org/snort-db/sid.html?sid=648
38- "SHELLCODE x86 setuid 0"; Snort Signature Database; http://www.snort.org/snort-db/sid.html?sid=650
39- Hawrylkiw, Dan; GCIA Certification – Practical Assignment; http://www.giac.org/practical/Dan_Hawrylkiw_GCIA.doc
40- Roesch, Marty; "[Snort-users] Weird fragmentation plugin error"; http://www.mcabee.org/lists/snort-users/Apr-01/msg00540.html
41- Attack Detail; "UDP Scan"; http://ki.sei.cmu.edu/idar/drill_attack.cfm?attack=UDP%20Scan
42- Vulnerability Detail; "Access to UDP based server"; http://ki.sei.cmu.edu/idar/drill_vuln.cfm?vulnerability=Access%20to%20UDP%20based%20server
43- SYN-Flood; Updated September 19, 1999; http://home.swipnet.se/~w-26153/syn.htm
44- Radigan, Jack; GCIA Certification – Practical Assignment; http://www.giac.org/practical/Jack_Radigan_GCIA.doc
45- Writing Snort Rules; http://www.defcon.tv/papers/IDS/snort_rules.htm
46- Church, Joe; GCIA Certification – Practical Assignment; http://www.network-forensics.net/it%20papers/Joe_Church_GCIA.pdf
47- F-Secure; Information on Nimda; http://www.f-secure.com/v-descs/nimda.shtml
48- CERT.org; CERT® Advisory CA-2001-19 "Code Red" Worm Exploiting Buffer Overflow In IIS Indexing Service DLL; http://www.cert.org/advisories/CA-2001-19.html